FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT OF COMMERCE

BULLETIN

BUREAU OF THE CENSUS

DRAINAGE : TEXAS

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

INTRODUCTION.

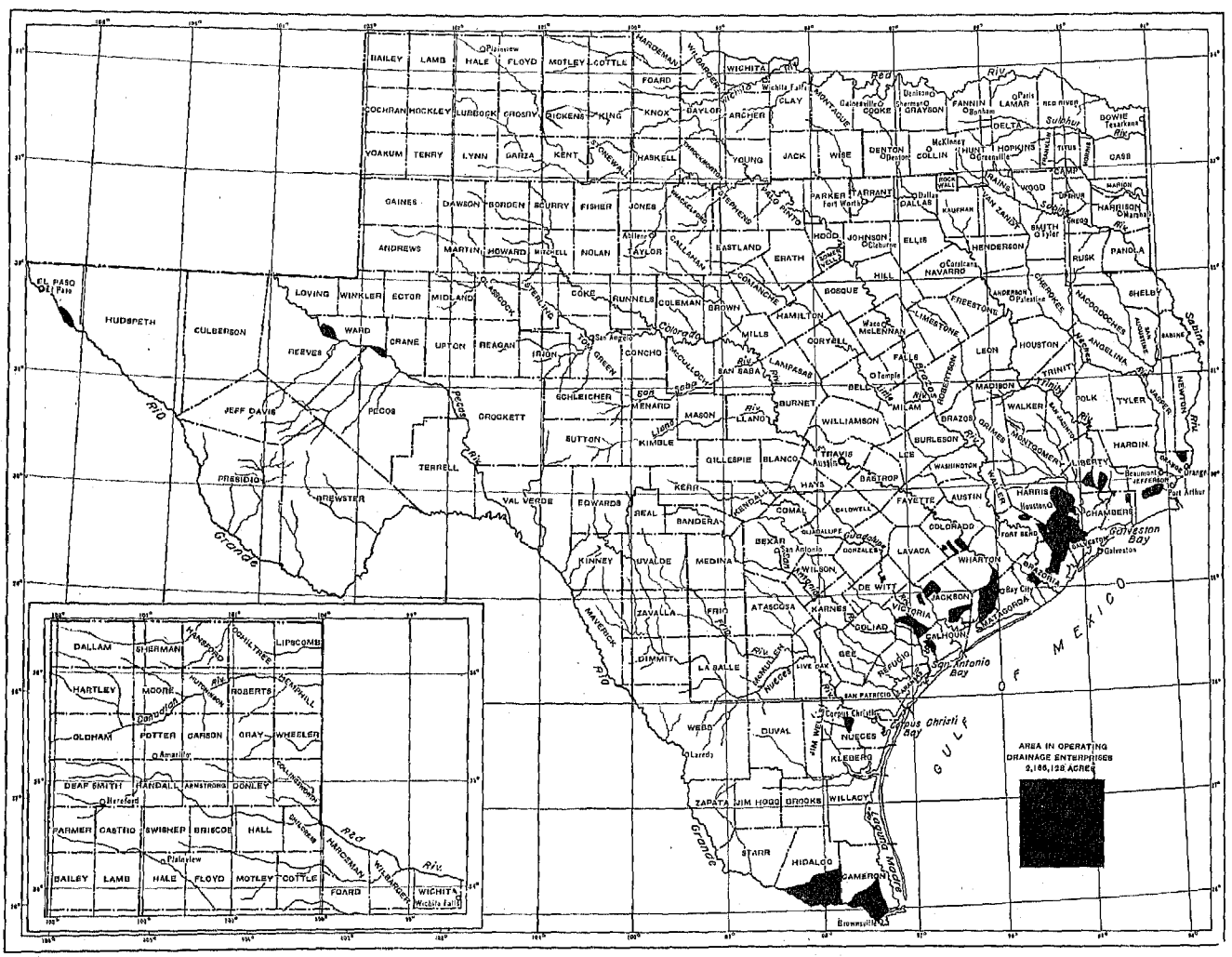
This bulletin presents the statistics of drainage for Texas collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land that is not yet included in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are shown separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state	436,033	100.0
Farms reporting land having drainage	8,106	1.9
Farms reporting land needing drainage	35,108	8.1
All land in farms—acres	114,020,621	100.0
Improved land in farms—acres	31,227,503	27.4
Farm land reported as provided with drainage—acres	756,263	0.7
Farm land reported as needing drainage—acres	4,130,614	3.6
DRAINAGE ENTERPRISES.		
Approximate land area of the state—acres	167,934,720	100.0
All land in operating drainage enterprises—acres	2,166,128	1.3
Improved land—acres	1,107,153	0.7
Timber and cut-over land—acres	111,922	0.1
Other unimproved land—acres	947,053	0.6
Capital invested in and required for completion of operating enterprises	$6,400,805	100.0
Capital invested in these enterprises to Dec. 31, 1919	$5,700,805	89.1
Additional capital required to complete these enterprises	$700,000	10.9

TEXAS

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (*a*) improved land; (*b*) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (*c*) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in Texas. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of drainage works some years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL.[1]		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All operating enterprises[2]	2,166,128	100.0	$5,700,805	100.0	$700,000
With works completed	2,080,128	96.0	5,055,805	88.7	.....
With works under construction	86,000	4.0	645,000	11.3	700,000

[1] The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."
[2] No nonoperating enterprises were reported in Texas.

Location of enterprises.—The greater part of the land in drainage enterprises in Texas is situated in the counties near the gulf coast, more particularly in the eastern part of the state. There is a large area in such enterprises in the lower Rio Grande Valley, near Brownsville, and three areas in the upper Rio Grande and Pecos River Valleys. The approximate location of the land in the drainage enterprises is shown by the map on page 2, but it was necessary to prepare that map from information which, in many instances, was very indefinite regarding the location of the enterprise within the county.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All operating enterprises[1]	2,166,128	100.0	$5,700,805	100.0	$700,000
Pecos River	47,440	2.2	83,000	1.5	.....
Rio Grande	513,871	23.7	1,261,000	22.1	600,000
San Antonio River	50,000	2.3	56,680	1.0	.....
Colorado River	288,281	13.3	765,824	13.4	100,000
Brazos River	205,707	9.5	682,000	12.0	.....
Trinity River	92,589	4.3	202,500	3.6	.....
Sabine Lake	68,275	3.2	116,600	2.0	.....
Gulf of Mexico	899,965	41.5	2,533,201	44.4	.....

[1] No nonoperating enterprises were reported in Texas.

Condition of land in enterprises.—The drainage enterprises in the eastern part of Texas are for the drainage and reclamation of land generally swampy or subject to overflow. In the counties bordering the Gulf of Mexico are extensive tracts so little above sea level that the winding streams are too sluggish to drain the land. In the western part of the state, artificial drainage is for the reclamation and protection of land injured or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. In the Brownsville section are conditions like those of the humid eastern counties and others like those of the arid western region.

For the state, 8,000 acres of irrigated land in drainage enterprises are reported as not having needed drainage, but as having been assessed merely for contributing to the injury of the other land. This acreage is omitted from the tabulations.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.[1]			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises	2,166,128	100.0	2,080,128	86,000
Improved land	1,107,153	51.1	1,052,653	54,500
Timber and cut-over land	111,922	5.2	111,922	.....
Other unimproved land	947,053	43.7	915,553	31,500
Swampy, overflowed, seeped, or alkali	201,051	9.3	183,451	17,600
Suffering loss of crops	128,765	5.9	116,965	11,800

[1] No nonoperating enterprises were reported in Texas.

Size of enterprises.—There are 54 operating drainage enterprises in Texas, with an average area of 40,113 acres. Of this number, 30 are of 10,000 to 50,000 acres each, and only 8 are smaller than 10,000 acres each. There is no overlapping of the enterprises in this state, and no enterprise is situated in more than one county.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises	2,166,128	2,166,128	100.0
200 to 499 acres	1,957	1,957	0.1
500 to 999 acres	.....	.....	.....
1,000 to 4,999 acres	9,619	9,619	0.4
5,000 to 9,999 acres	32,032	32,032	1.5
10,000 to 49,999 acres	746,544	746,544	34.5
50,000 to 99,999 acres	918,105	918,105	42.4
100,000 acres and over	457,871	457,871	21.1

Character of enterprises.—The drainage enterprises in Texas are drainage districts organized under the state drainage district laws of 1907 and 1911, drainage work in the Rio Grande Project of the United States Reclamation Service, a small levee improvement district that has constructed drainage ditches, and one enterprise under private ownership.

The office of State Reclamation Engineer was created by an act of April 7, 1913, to plan and lay out the improvements necessary to reclaim the swamp and overflowed land of the state and make it suitable for agricultural uses. This act abolished the State Levee and Drainage Board and the office of the State Levee and Drainage Commissioner, created by act of March 19, 1909 (ch. 81), which was rewritten by act of March 20, 1911 (ch. 88). It is specifically provided that no money appropriated by the act shall be used for construction of the improvement works. The law requires that each drainage, levee, or improvement district shall file with the State Reclamation Engineer a complete record of its organization, plans, and estimates, immediately prior to the approval of its bond issue by the attorney general of the state.

The drainage district law approved March 28, 1911 (ch. 118), supersedes the act of March 23, 1907 (ch. 40), which was similar to the later law in its principal provisions. The present statute authorizes the establishment of drainage districts by the county commissioners' court, upon petition from 25 freehold resident taxpayers or from one-third of all such taxpayers in the proposed district. After the sufficiency of the petition is determined at public hearing, the commissioners appoint an engineer to make a survey and preliminary plans for the improvement works. Public hearing is held again upon the engineer's report. Before the district is organized, the issue of bonds and levy of the drainage tax must be approved by two-thirds of the voting property taxpayers at a special election. Three drainage commissioners to administer the affairs of the district are appointed by the county commissioners, or they are elected by the real property taxpayers of the district if a majority of those taxpayers petition for such an election. The bonds of the district may not be issued for longer than 40 years, and must be approved by the attorney general of the state. They are paid by the proceeds of taxes levied annually upon all real, personal, and other property in the district. This law does not provide for organizing a drainage district located in more than one county. The several amendments to this law have not affected the character of the enterprises as described.

Levee improvement districts are organized under a law of April 1, 1915 (ch. 146), which repealed a somewhat similar law of March 19, 1909 (ch. 85). These districts are established by the county commissioners' court upon petition from the owners of a majority of the acreage in the proposed district, and each is under the control of three district supervisors appointed by the court. Bond issues and taxes for drainage must be approved as in drainage districts. The Conservation and Reclamation District Act of March 24, 1919 (ch. 44), makes it unlawful for any levee improvement district to construct or maintain any levee or other improvement without first obtaining the State Reclamation Engineer's approval of the proposed work.

The first public drainage law of Texas was passed in April, 1895 (ch. 97). It provided for the establishment of drainage districts by the county commissioners' court, to be under the control of that court, upon petition from five owners of land to be affected. The work was to be apportioned to each tract of land, corporation, county highway, and railroad in proportion to the benefits to be derived by each. A similar law was enacted in 1897 (ch. 77). An act of April 11, 1899 (ch. 64), authorizes the creation of drainage districts by the county commissioners' court, to be controlled by that court, the cost of drainage to be paid by an ad valorem tax upon all property in the county or subdivision thereof. A statute of 1905 (ch. 110) provides that drainage districts may be established by the county commissioners' court upon petition from 50 or a majority of the resident owners of land that will be affected, to be under the control of that court or of elected trustees as desired by the property holders. This act authorizes the formation of drainage districts situated in two or more counties. No enterprises were reported as organized under these laws, though all are still in effect except in so far as that of 1895 has been superseded by that of 1897.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All operating enterprises[1]	2,166,128	100.0	$5,700,805	100.0	$700,000
Drainage districts	2,096,282	96.8	4,954,981	86.9	100,000
Laws of 1907, ch. 40	1,560,205	72.0	3,266,380	57.3	.....
Laws of 1911, ch. 118	536,077	24.7	1,688,601	29.6	100,000
U. S. Reclamation Service	55,000	2.6	635,000	11.1	600,000
Other[2]	13,846	0.6	110,824	1.9	.....

[1] No nonoperating enterprises were reported in Texas.
[2] Includes 1,477 acres in a levee improvement district under laws of 1915 (ch. 146); 7,500 acres under individual ownership; and 4,869 acres in a drainage district under a law not specified.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 2,728.5 miles of open ditches and 59.8 miles of accessory levees; the additional works under construction were 95.6 miles of open ditches only. These figures do not include drains installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of open ditches or tile drains. There are no pumping districts for land drainage in the state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All kinds	2,166,128	100.0	$5,700,805	100.0	$700,000
Open ditches only	1,617,933	74.7	4,889,205	85.8	700,000
Open ditches and levees	548,195	25.3	811,600	14.2	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those of 10 feet and more were omitted; to include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 4.0 instead of 3.8 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises	2,166,128	100.0
Less than 3 feet	64,250	3.0
3.0 to 3.9 feet	585,086	27.0
4.0 to 4.9 feet	808,948	37.3
5.0 to 5.9 feet	249,207	11.5
6.0 to 6.9 feet	1,477	0.1
7.0 to 7.9 feet	20,289	0.9
8.0 to 8.9 feet	.....	.....
9.0 to 9.9 feet	.....	.....
10.0 feet and more	56,000	2.6
Not reporting branches	380,871	17.6

Maintenance of works.—The drainage district law of 1911, as amended March 5, 1915 (ch. 33), provides for the maintenance of each drainage district by the commissioners of the district, who must submit annually to the county commissioners' court a report of the condition of the district and estimates for the maintenance work required. Taxes are levied by the court on all property in the district sufficient to pay for the maintenance, but not to exceed in any year one-half of 1 per cent of the assessed valuation, and when collected are placed in the construction and maintenance fund of the district. Bonds not required for construction cost may be sold, with the consent of the court, for maintenance purposes. The drainage law of 1907 also provided that it should be the duty of the drainage commissioners to maintain the drainage works of the districts established under that statute.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All operating enterprises	2,166,128	100.0	$5,700,805	100.0	$700,000
By district forces	1,852,087	85.5	4,919,205	86.3	700,000
By contract	284,541	13.1	707,000	12.4	.....
No maintenance provided [1]	29,500	1.4	74,600	1.3	.....

[1] Includes 7,500 acres maintained by landowners.

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county commissioners' courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises	2,166,128	100.0	2,166,128	100.0
1900 to 1904	7,500	0.3	7,500	0.3
1905 to 1909	886,481	40.9	886,481	40.9
1910 to 1914	1,009,724	46.6	1,009,724	46.6
1915 to 1919	262,423	12.1	262,423	12.1

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises	$5,700,805	100.0	$700,000
1900 to 1904	50,000	0.9	.....
1905 to 1909	1,580,000	27.7	.....
1910 to 1914	3,362,876	59.0	600,000
1915 to 1919	707,929	12.4	100,000

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees	2,824.1	100.0	59.8	100.0
1900 to 1904	6.2	0.2	4.0	6.7
1905 to 1909	612.3	21.7	52.0	87.0
1910 to 1914	1,746.7	61.8	1.0	1.7
1915 to 1919	458.9	16.2	2.8	4.7

Crops.—The principal crops grown upon the drained land in drainage enterprises are cotton, corn, and vegetables. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Bandera.	Bastrop.	Bell.	Bexar.	Blanco.	Bosque.	Bowie.	Brazoria.
1	Number of all farms in the state or county	436,033	670	3,325	4,555	3,205	713	2,467	4,970	2,074
2	Farms reporting land having drainage	8,106	59	92	22	34	145	29	8	730
3	Farms reporting land needing drainage	35,108	326	145	.....	294	250	154	130	78
4	Farms in drainage and levee districts	2,778	2	3	.....	15	1	.....	1	723
	LAND AND FARM AREA.									
5	Approximate land area of the state or county—acres	167,934,720	519,040	554,880	693,120	808,320	480,000	624,000	558,720	857,600
6	All land in farms—acres	114,020,621	464,199	390,582	534,247	576,218	429,221	539,735	316,692	303,037
7	Improved land in farms—acres	31,227,503	37,912	182,718	372,040	234,287	46,532	201,131	200,907	165,150
8	Woodland in farms—acres	14,532,913	5,296	162,116	102,113	86,339	53,223	131,799	106,203	60,048
9	Other unimproved land in farms—acres	68,260,205	420,991	45,748	60,094	255,592	329,466	206,805	9,582	77,839
10	Farm land reported as provided with drainage—acres	756,263	2,150	7,117	1,545	1,020	7,930	1,494	3,148	86,337
11	Farm land reported as needing drainage—acres	4,130,614	24,154	9,683	.....	19,700	12,576	6,861	7,321	24,010
12	Drainage only—acres	385,225	12	819	.....	115	100	626	81	5,666
13	Drainage and clearing—acres	3,745,389	24,142	8,864	.....	19,585	12,476	6,235	7,240	18,344

		Brazos.	Brown.	Burleson.	Calhoun.	Cameron.	Cass.	Chambers.	Clay.	Collin.
1	Number of all farms in the county	3,023	2,303	2,685	533	1,507	5,355	506	2,118	6,001
2	Farms reporting land having drainage	93	56	17	333	26	115	21	7	12
3	Farms reporting land needing drainage	54	385	174	278	19	985	135	188	6
4	Farms in drainage and levee districts	2	.....	38	104	39	3	1	.....	.....
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	382,080	611,840	437,760	360,320	896,640	608,640	395,520	741,120	561,920
6	All land in farms—acres	277,405	545,472	293,063	163,494	299,279	429,423	179,430	721,789	462,225
7	Improved land in farms—acres	143,516	182,004	140,697	53,602	83,121	238,140	51,321	276,527	410,478
8	Woodland in farms—acres	115,797	147,671	134,010	9,240	20,046	180,404	8,846	89,425	21,276
9	Other unimproved land in farms—acres	18,093	215,797	18,356	100,652	187,112	10,819	119,263	355,837	21,471
10	Farm land reported as provided with drainage—acres	4,916	4,262	927	36,668	1,566	3,092	462	1,130	411
11	Farm land reported as needing drainage—acres	6,315	26,737	14,514	57,008	1,192	53,090	8,683	27,937	267
12	Drainage only—acres	886	140	482	28,390	165	1,285	4,087	1,566	18
13	Drainage and clearing—acres	5,429	26,597	14,032	28,618	1,027	51,805	4,596	26,371	249

		Colorado.	Comanche.	Cooke.	Coryell.	Dallas.	Delta.	Denton.	El Paso.	Ellis.
1	Number of all farms in the county	2,469	3,015	2,919	3,069	5,379	2,191	4,200	542	5,774
2	Farms reporting land having drainage	126	346	17	311	49	24	35	158	40
3	Farms reporting land needing drainage	417	201	163	479	139	140	248	68	18
4	Farms in drainage and levee districts	42	.....	1	9	16	3	.....	136	3
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	622,080	606,720	577,280	694,400	549,760	167,040	609,280	590,720	624,000
6	All land in farms—acres	457,296	454,339	440,101	559,051	453,167	145,476	528,215	217,367	530,195
7	Improved land in farms—acres	169,846	216,129	237,874	246,011	358,570	123,512	395,308	30,119	469,771
8	Woodland in farms—acres	150,468	146,597	79,654	158,975	36,024	15,261	69,507	638	15,931
9	Other unimproved land in farms—acres	136,982	91,613	122,573	154,065	58,573	6,703	63,400	186,610	44,493
10	Farm land reported as provided with drainage—acres	19,985	20,609	918	18,509	3,276	1,384	812	14,052	2,361
11	Farm land reported as needing drainage—acres	33,914	13,152	5,022	22,587	10,023	3,746	7,300	4,275	1,801
12	Drainage only—acres	14,725	1,769	266	829	3,804	10	2,120	877	484
13	Drainage and clearing—acres	19,189	11,383	4,756	21,758	6,219	3,736	5,180	3,398	1,317

		Erath.	Fannin.	Fayette.	Fort Bend.	Galveston.	Gonzales.	Grayson.	Hamilton.	Hardeman.
1	Number of all farms in the county	3,387	6,338	4,728	3,325	723	4,361	5,569	2,049	1,077
2	Farms reporting land having drainage	16	106	218	8	136	44	86	14	18
3	Farms reporting land needing drainage	257	589	511	123	55	685	159	136	73
4	Farms in drainage and levee districts	3	3	24	1	8	10	5	.....	13
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	693,120	536,320	619,520	506,880	252,800	652,800	602,880	533,120	487,040
6	All land in farms—acres	556,065	460,727	514,358	384,741	102,332	608,301	508,520	444,790	366,152
7	Improved land in farms—acres	233,568	390,079	223,394	207,057	27,900	264,874	399,487	179,155	166,237
8	Woodland in farms—acres	122,209	50,948	204,520	49,716	3,935	204,477	61,001	74,192	3,320
9	Other unimproved land in farms—acres	200,288	19,700	86,444	127,968	70,497	138,950	48,032	191,443	196,595
10	Farm land reported as provided with drainage—acres	1,129	8,037	4,991	2,052	8,956	2,039	1,537	456	1,355
11	Farm land reported as needing drainage—acres	15,165	16,883	15,529	11,626	12,453	92,668	2,593	7,619	11,372
12	Drainage only—acres	1,260	4,533	1,301	9,456	12,023	908	648	61	854
13	Drainage and clearing—acres	13,905	12,350	14,228	2,170	430	91,760	1,945	7,558	10,518

		Harris.	Harrison.	Hidalgo.	Hopkins.	Hunt.	Jackson.	Jefferson.	Johnson.	Kaufman.
1	Number of all farms in the county	2,880	5,789	1,727	5,445	5,135	1,485	419	3,367	4,398
2	Farms reporting land having drainage	529	31	46	20	36	343	128	20	102
3	Farms reporting land needing drainage	769	767	96	59	93	140	56	26	325
4	Farms in drainage and levee districts	372	1	61	29	3	331	13	1	70
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	1,058,560	558,080	1,042,560	520,320	571,520	571,520	588,800	473,600	533,760
6	All land in farms—acres	379,262	390,842	394,874	397,734	432,751	398,771	130,230	370,817	397,980
7	Improved land in farms—acres	216,879	230,656	99,822	270,014	341,460	126,961	93,435	245,023	313,752
8	Woodland in farms—acres	69,149	147,839	14,455	89,252	59,762	74,751	7,491	31,823	53,198
9	Other unimproved land in farms—acres	93,234	12,347	280,597	38,468	31,529	197,059	29,304	93,971	31,030
10	Farm land reported as provided with drainage—acres	135,200	610	3,486	946	2,530	38,182	36,446	720	11,000
11	Farm land reported as needing drainage—acres	109,378	39,418	56,455	2,357	3,734	50,253	16,986	706	18,112
12	Drainage only—acres	84,984	744	1,869	112	1,609	13,699	13,759	398	2,830
13	Drainage and clearing—acres	24,394	38,674	54,586	2,245	2,125	36,554	3,227	308	15,282

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Kendall.	Kent.	Kerr.	Lamar.	Lampasas.	Lee.	Leon.	Liberty.	Limestone.
1	Number of all farms in the county	617	412	561	6,831	1,139	2,295	3,301	1,314	5,095
2	Farms reporting land having drainage	19	14	47	436	77	49	21	217	115
3	Farms reporting land needing drainage	113	11	161	221	212	455	322	210	399
4	Farms in drainage and levee districts	.....	.....	9	21	2	1	3	154	3
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	382,720	560,000	730,880	604,800	473,600	359,680	704,640	742,400	623,360
6	All land in farms—acres	376,306	349,054	679,768	450,761	394,626	309,873	448,037	199,957	402,388
7	Improved land in farms—acres	37,688	48,868	30,429	354,037	104,066	113,741	176,220	73,449	346,027
8	Woodland in farms—acres	66,038	25,291	168	80,243	47,807	183,416	253,551	44,117	75,293
9	Other unimproved land in farms—acres	272,580	275,495	643,171	15,881	242,753	12,716	18,866	82,391	41,068
10	Farm land reported as provided with drainage—acres	780	2,310	2,091	25,069	2,446	503	740	39,438	6,806
11	Farm land reported as needing drainage—acres	4,833	10,050	26,586	8,705	14,875	29,062	34,824	49,190	17,993
12	Drainage only—acres	18	1,100	370	1,485	259	379	614	30,715	421
13	Drainage and clearing—acres	4,815	8,950	26,216	7,220	14,616	28,683	34,210	18,475	17,572

		McCulloch.	McLennan.	Madison.	Matagorda.	Milam.	Montague.	Morris.	Nacogdoches.	Navarro.
1	Number of all farms in the county	1,207	5,709	2,226	1,616	5,606	3,005	1,745	4,219	6,293
2	Farms reporting land having drainage	2	23	106	108	79	9	29	105	45
3	Farms reporting land needing drainage	176	154	296	66	409	101	365	798	481
4	Farms in drainage and levee districts	.....	26	.....	47	1	4	.....	1	5
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	686,720	671,360	316,800	727,040	613,760	594,560	165,760	677,760	678,400
6	All land in farms—acres	466,579	568,599	241,726	406,587	480,353	449,506	112,367	406,628	566,919
7	Improved land in farms—acres	131,795	440,977	103,952	221,076	328,555	201,317	71,688	197,497	438,853
8	Woodland in farms—acres	20,036	50,333	119,005	48,828	105,927	145,832	32,724	196,288	82,990
9	Other unimproved land in farms—acres	314,748	71,289	18,769	136,683	45,871	102,357	7,955	12,843	45,057
10	Farm land reported as provided with drainage—acres	1,928	2,556	1,835	58,606	2,257	750	603	3,740	2,661
11	Farm land reported as needing drainage—acres	9,556	8,072	21,106	25,034	21,068	4,391	9,391	43,165	22,063
12	Drainage only—acres	.....	2,356	282	14,837	512	1,574	709	550	74
13	Drainage and clearing—acres	9,556	5,716	20,884	10,197	21,156	2,817	8,682	42,615	21,989

		Nueces.	Orange.	Palo Pinto.	Parker.	Polk.	Presidio.	Red River.	Reeves.	Refugio.
1	Number of all farms in the county	1,247	311	1,242	2,945	2,022	102	5,832	206	310
2	Farms reporting land having drainage	7	149	21	27	58	2	53	2	21
3	Farms reporting land needing drainage	41	226	70	154	546	10	102	2	65
4	Farms in drainage and levee districts	12	17	.....	.....	.....	1	13	2	2
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	496,000	232,320	613,120	560,000	778,880	2,439,680	664,960	1,779,840	473,600
6	All land in farms—acres	323,935	64,872	432,443	456,447	161,408	1,212,914	385,236	1,050,716	155,983
7	Improved land in farms—acres	162,621	26,071	94,944	195,542	61,960	6,723	261,996	16,385	35,988
8	Woodland in farms—acres	13,008	20,330	113,186	142,412	95,988	.....	115,466	.....	4,209
9	Other unimproved land in farms—acres	148,216	18,462	224,313	118,493	3,460	1,206,191	7,774	1,034,331	115,726
10	Farm land reported as provided with drainage—acres	3,167	12,305	547	651	2,145	408	1,220	500	6,221
11	Farm land reported as needing drainage—acres	18,358	23,960	7,533	4,597	32,498	13,475	5,878	1,822	21,131
12	Drainage only—acres	130	9,330	130	70	804	12,508	855	22	3,426
13	Drainage and clearing—acres	18,228	14,621	7,403	4,527	31,694	907	5,023	1,800	17,705

		Robertson.	Rusk.	San Patricio.	Smith.	Tarrant.	Titus.	Tom Green.	Tyler.	Upshur.
1	Number of all farms in the county	4,903	6,059	757	6,317	3,336	2,938	680	1,134	3,690
2	Farms reporting land having drainage	75	159	10	191	16	20	5	75	53
3	Farms reporting land needing drainage	211	898	236	387	22	264	81	675	515
4	Farms in drainage and levee districts	3	2	12	1	7	3	.....	1	42
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	558,080	629,120	432,640	588,800	577,920	254,720	930,560	581,120	384,000
6	All land in farms—acres	392,122	486,963	204,295	456,057	395,322	195,771	750,063	128,988	205,381
7	Improved land in farms—acres	236,513	283,148	96,007	294,948	253,224	116,478	95,530	35,123	158,806
8	Woodland in farms—acres	132,496	183,704	31,084	131,727	71,487	68,476	44,054	88,111	96,301
9	Other unimproved land in farms—acres	23,113	20,111	77,204	29,382	70,611	10,817	611,079	5,754	10,274
10	Farm land reported as provided with drainage—acres	5,043	3,758	2,892	5,560	521	434	515	1,076	1,294
11	Farm land reported as needing drainage—acres	15,991	33,490	31,556	11,187	288	6,140	159,161	49,103	22,319
12	Drainage only—acres	1,234	495	440	594	121	6	1,420	201	685
13	Drainage and clearing—acres	14,757	32,995	31,116	10,593	167	6,134	157,741	48,842	21,634

		Val Verde.	Victoria.	Ward.	Washington.	Webb.	Wharton.	Williamson.	Young.	All other counties.[1]
1	Number of all farms in the county	285	2,101	238	4,158	257	2,967	4,598	1,480	184,957
2	Farms reporting land having drainage	92	239	57	135	6	3	30	7	286
3	Farms reporting land needing drainage	6	281	19	371	11	44	58	439	14,031
4	Farms in drainage and levee districts	.....	179	54	.....	.....	1	1	2	56
	LAND AND FARM AREA.									
5	Approximate land area of the county—acres	1,973,120	569,600	529,280	401,920	2,060,160	711,680	722,560	560,000	111,180,800
6	All land in farms—acres	1,699,287	551,984	349,476	348,026	971,850	438,068	610,036	484,282	75,726,897
7	Improved land in farms—acres	7,059	151,090	19,051	188,202	21,698	245,952	393,663	147,107	14,888,264
8	Woodland in farms—acres	315	114,312	5,000	85,950	114,039	41,875	129,004	71,271	7,596,448
9	Other unimproved land in farms—acres	1,691,913	286,582	325,425	73,874	835,513	150,241	87,369	265,904	53,242,186
10	Farm land reported as provided with drainage—acres	1,155	20,114	6,612	6,239	918	1,465	943	485	8,483
11	Farm land reported as needing drainage—acres	503	45,172	2,594	20,455	1,680	4,406	4,201	54,117	2,293,110
12	Drainage only—acres	188	22,424	582	3,424	470	1,966	117	365	46,524
13	Drainage and clearing—acres	315	22,748	2,012	17,031	1,210	2,440	4,174	53,752	2,246,586

[1] Drainage on farms reported only in Anderson, Angelina, Archer, Atascosa, Austin, Briscoe, Brooks, Burnet, Caldwell, Camp, Coleman, Collingsworth, Comal, Culberson, De Witt, Falls, Franklin, Freestone, Gillespie, Goliad, Gregg, Grimes, Guadalupe, Hardin, Haskell, Hays, Hemphill, Henderson, Hill, Hood, Houston, Jack, Jasper, Jim Wells, Kimble, Kleberg, Lavaca, Live Oak, Llano, Marion, Mason, Maverick, Medina, Mills, Mitchell, Montgomery, Nolan, Panola, Pecos, Rains, Rockwall, Runnels, Sabine, San Augustine, San Saba, Stephens, Stonewall, Swisher, Taylor, Terrell, Travis, Trinity, Uvalde, Van Zandt, Walker, Wilson, and Wood Counties.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Brazoria.	Calhoun.	Cameron.	Chambers.	Colorado.	De Witt.	El Paso.	Fort Bend.	Galveston.	Harris.
	LAND AREA.											
1	Approximate land area of the state or county.....acres..	167,934,720	857,600	360,320	896,640	395,520	622,080	562,560	590,720	506,880	252,800	1,058,560
2	All land in operating drainage enterprises.....acres..	2,166,128	327,362	36,426	202,556	16,000	48,250	9,600	56,000	36,915	93,911	238,266
3	Improved land.....acres..	1,107,153	[1]145,000	27,320	[1]78,000	12,500	25,650	1,920	28,500	27,086	[1]25,899	142,148
4	Per cent of all improved land in farms.....	3.5	87.8	51.0	93.8	24.4	15.1	0.9	94.6	13.4	92.8	65.5
5	Timber and cut-over land.....acres..	111,922	2,072	.....	.....	900	475	.....	.....	.....	.....	79,770
6	Other unimproved land.....acres..	947,053	180,290	9,106	124,556	2,600	22,125	7,680	27,500	9,229	68,012	16,348
7	Swampy, seeped, or alkali, in enterprises.....acres..	201,051	32,736	3,643	10,256	2,600	12,000	.....	5,600	4,459	18,782	47,835
8	Suffering loss of crops from defective drainage.....acres..	128,765	17,916	2,732	10,256	2,050	7,200	.....	5,600	3,345	11,269	23,211
9	Assessed acreage.....	2,166,128	327,362	36,426	202,556	16,000	48,250	9,600	56,000	36,915	93,911	238,266
10	Excess over all land in operating enterprises...acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	DRAINAGE WORKS.											
	Open ditches:											
11	Completed.....miles..	2,728.5	456.2	45.0	165.0	30.0	28.4	4.0	70.0	177.0	80.0	497.0
12	Additional under construction.....miles..	95.6	.....	.....	.....	.....	48.6	.....	47.0	.....	.....	.....
13	Maximum completed in any enterprise.....miles..	140.0	120.0	45.0	100.0	20.0	14.0	4.0	70.0	140.0	44.0	122.0
14	Maximum width at bottom of ditch[2].....feet..	200	18	14	25	8	11	12	12	60	12	20
15	Maximum of average depths of outlet ditches[2]..feet..	10.0	5.0	4.0	6.0	8.0	4.0	4.0	10.0	5.0	4.0	6.0
16	Mean depth of branch ditches[2].....feet..	3.8	3.4	4.0	5.2	3.0	3.6	4.0	.....	3.5	3.5	4.0
	Accessory levees and dikes:											
17	Completed.....miles..	59.8	15.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	Additional under construction.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	Area drained by open ditches only[2].....acres..	1,617,933	285,927	36,426	202,556	16,000	48,250	9,600	56,000	36,915	93,911	238,266
20	Length of these ditches.....miles..	2,567.0	375.2	45.0	165.0	30.0	77.0	4.0	117.0	177.0	80.0	497.0
21	Average length per acre.....feet..	8.4	6.9	6.5	4.3	9.9	8.4	2.2	11.0	25.3	4.5	9.6
22	Area having open ditches and levees[2].....acres..	548,195	41,435	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	Length of these ditches.....miles..	257.1	81.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	Average length per acre.....feet..	2.5	10.3	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Length of the accessory levees.....miles..	59.8	15.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
	DEVELOPMENT OF LAND.											
26	Improved land in operating enterprises, 1920.....acres..	1,107,153	[1]145,000	27,320	[1]78,000	12,500	25,650	1,920	28,500	27,086	[1]25,899	142,148
27	Improved land prior to drainage.....acres..	566,275	105,954	9,106	54,625	8,600	21,380	1,920	28,000	27,086	18,782	23,827
28	Increase since drainage.....acres..	540,878	39,046	18,214	23,375	3,900	4,270	.....	500	.....	7,117	118,321
29	Per cent of increase.....	95.5	36.9	200.0	42.8	45.3	20.0	.....	1.8	.....	37.9	496.6
30	Per cent increase is of all improved land in farms, 1920.....	1.7	23.6	34.0	28.1	7.6	2.5	.....	1.7	.....	25.5	54.6
31	Timber and cut-over land, 1920.....acres..	111,922	2,072	.....	.....	900	475	.....	.....	.....	.....	79,770
32	Timber and cut-over land prior to drainage.....acres..	116,642	2,072	.....	.....	2,000	475	.....	.....	.....	.....	79,770
33	Decrease since drainage.....acres..	4,720	.....	.....	.....	1,100	.....	.....	.....	.....	.....	.....
34	Per cent of decrease.....	4.0	.....	.....	.....	55.0	.....	.....	.....	.....	.....	.....
35	Other unimproved land, 1920.....acres..	947,053	180,290	9,106	124,556	2,600	22,125	7,680	27,500	9,229	68,012	16,348
36	Other unimproved land prior to drainage.....acres..	1,483,211	219,336	27,320	147,931	5,400	26,395	7,680	28,000	9,229	75,129	134,663
37	Decrease since drainage.....acres..	536,158	39,046	18,214	23,375	2,800	4,270	.....	500	.....	7,117	118,321
38	Per cent of decrease.....	36.1	17.8	66.7	15.8	51.9	16.2	.....	1.8	.....	9.5	87.9
39	Swampy or subject to overflow, 1920.....acres..	201,051	32,736	3,643	10,256	2,600	12,000	.....	5,600	4,459	18,782	47,835
40	Swampy or subject to overflow prior to drainage...acres..	1,000,442	130,946	18,213	48,738	13,300	24,020	5,760	14,000	27,080	56,347	152,321
41	Decrease since drainage.....acres..	799,391	98,210	14,570	38,482	10,700	12,020	5,760	8,400	23,227	37,565	104,486
42	Per cent of decrease.....	79.9	75.0	80.0	79.0	80.5	50.0	100.0	60.0	83.9	66.7	68.6
	CAPITAL INVESTED AND COST PER ACRE.											
43	Total capital invested in and required for completion of operating enterprises.....dollars..	6,400,805	1,064,000	60,000	757,120	23,000	140,000	30,000	1,235,000	180,000	165,000	615,000
44	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	5,700,805	1,064,000	60,000	757,120	23,000	40,000	30,000	635,000	180,000	165,000	615,000
45	Additional capital required to complete these enterprises.....dollars..	700,000	.....	.....	.....	.....	100,000	.....	600,000	.....	.....	.....
46	Average cost per acre when completed...dollars..	2.95	3.25	1.65	3.74	1.44	2.90	3.13	22.05	4.88	1.76	2.58
47	Enterprises constructing open ditches only.....dollars..	5,589,205	864,000	60,000	757,120	23,000	140,000	30,000	1,235,000	180,000	165,000	615,000
48	Average cost per acre when completed .....dollars..	3.45	3.02	1.65	3.74	1.44	2.90	3.13	22.05	4.88	1.76	2.58
49	Enterprises constructing open ditches and levees..dollars..	811,600	200,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	Average cost per acre when completed .....dollars..	1.48	4.83	.....	.....	.....	.....	.....	.....	.....	.....	.....
	CROPS.											
	Improved land in enterprises reporting—											
51	Corn as principal crop on drained land.....acres..	490,263	145,000	27,320	.....	.....	4,275	.....	.....	.....	.....	32,374
52	Cotton as principal crop on drained land.....acres..	350,516	.....	.....	31,020	.....	.....	1,920	.....	27,086	25,899	109,774
53	Vegetables as principal crop on drained land...acres..	145,703	.....	.....	46,980	.....	.....	.....	.....	.....	.....	.....
54	Alfalfa as principal crop on drained land.....acres..	28,500	.....	.....	.....	.....	.....	.....	28,500	.....	.....	.....
55	Other crops as principal ones on drained land..acres..	92,171	.....	.....	.....	12,500	21,375	.....	.....	.....	.....	.....

[1] Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.
[2] When works under construction have been completed.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Henderson.	Hidalgo.	Jackson.	Jefferson.	Liberty.	Matagorda.	Nueces.	Orange.	Victoria.	Ward.	Wharton.
LAND AREA.											
1 Approximate land area of the county....acres..	605,440	1,042,560	571,520	588,800	742,400	727,040	496,000	232,320	569,600	529,280	711,680
2 All land in operating drainage enterprises....acres..	1,477	357,871	137,873	46,275	91,112	223,394	23,763	22,000	133,000	47,440	16,637
3 Improved land....acres..	977	[1] 98,723	96,265	20,824	57,863	167,218	9,505	6,600	102,750	[1] 17,664	14,141
4 Per cent of all improved land in farms....	0.5	98.9	75.8	22.3	78.8	75.4	5.8	25.3	68.0	92.7	5.7
5 Timber and cut-over land....acres..	500	.....	14,021	2,314	120	750	.....	11,000	.....	.....	.....
6 Other unimproved land....acres..	.....	259,148	27,587	23,137	33,129	55,426	14,258	4,400	30,250	29,776	2,496
7 Swampy, seeped, or alkali, in enterprises....acres..	.....	.....	6,451	4,628	4,532	27,065	.....	5,500	13,300	.....	1,664
8 Suffering loss of crops from defective drainage....acres..	.....	.....	4,392	2,082	2,875	22,498	.....	1,650	10,275	.....	1,414
9 Assessed acreage....	1,477	357,871	137,873	46,275	91,112	223,394	23,763	22,000	133,000	47,440	16,637
10 Excess over all land in operating enterprises....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
DRAINAGE WORKS.											
Open ditches:											
11 Completed....miles..	2.9	25.0	537.5	15.0	125.1	210.4	55.0	30.0	195.0	49.0	21.0
12 Additional under construction....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13 Maximum completed in any enterprise....miles..	2.9	25.0	122.0	15.0	60.1	75.0	55.0	30.0	110.0	30.0	21.0
14 Maximum width at bottom of ditch [2]....feet..	20	200	20	60	30	12	12	10	12	6	8
15 Maximum of average depths of outlet ditches [2]....feet..	6.0	5.0	4.0	4.0	5.0	6.0	4.0	5.0	4.0	5.0	4.0
16 Mean depth of branch ditches [2]....feet..	6.0	.....	3.0	3.0	3.9	4.0	4.0	.....	3.3	5.0	3.0
Accessory levees and dikes:											
17 Completed....miles..	1.8	15.0	1.0	.....	.....	26.0	.....	1.0	.....	.....	.....
18 Additional under construction....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19 Area drained by open ditches only [2]....acres..	.....	.....	114,873	46,275	91,112	120,982	23,763	.....	133,000	47,440	16,637
20 Length of these ditches....miles..	.....	.....	460.5	15.0	125.1	169.2	55.0	.....	195.0	49.0	21.0
21 Average length per acre....feet..	.....	.....	21.2	1.7	7.2	7.4	12.2	.....	7.7	5.5	6.7
22 Area having open ditches and levees [2]....acres..	1,477	357,871	23,000	.....	.....	102,412	.....	22,000	.....	.....	.....
23 Length of these ditches....miles..	2.9	25.0	77.0	.....	.....	41.2	.....	30.0	.....	.....	.....
24 Average length per acre....feet..	10.4	0.4	17.7	.....	.....	2.1	.....	7.2	.....	.....	.....
25 Length of the accessory levees....miles..	1.8	15.0	1.0	.....	.....	26.0	.....	1.0	.....	.....	.....
DEVELOPMENT OF LAND.											
26 Improved land in operating enterprises, 1920....acres..	977	[1] 98,723	96,265	20,824	57,863	167,218	9,505	6,600	102,750	[1] 17,664	14,141
27 Improved land prior to drainage....acres..	.....	[3] 62,935	21,345	11,569	11,518	81,736	5,941	2,200	53,500	7,332	8,319
28 Increase since drainage....acres..	977	35,788	74,920	9,255	46,345	85,482	3,564	4,400	49,250	10,332	5,822
29 Per cent of increase....	.....	56.9	351.0	80.0	402.4	104.6	60.0	200.0	92.1	140.9	70.0
30 Per cent increase is of all improved land in farms, 1920....	0.5	35.9	50.0	9.9	63.1	38.6	2.2	16.9	32.6	54.2	2.4
31 Timber and cut-over land, 1920....acres..	500	.....	14,021	2,314	120	750	.....	11,000	.....	.....	.....
32 Timber and cut-over land prior to drainage....acres..	1,477	.....	16,544	2,314	240	750	.....	11,000	.....	.....	.....
33 Decrease since drainage....acres..	977	.....	2,523	.....	120	.....	.....	.....	.....	.....	.....
34 Per cent of decrease....	66.1	.....	15.3	.....	50.0	.....	.....	.....	.....	.....	.....
35 Other unimproved land, 1920....acres..	.....	259,148	27,587	23,137	33,129	55,426	14,258	4,400	30,250	29,776	2,496
36 Other unimproved land prior to drainage....acres..	.....	294,936	99,984	32,392	79,354	140,908	17,822	8,800	79,500	40,108	8,318
37 Decrease since drainage....acres..	.....	35,788	72,397	9,255	46,225	85,482	3,564	4,400	49,250	10,332	5,822
38 Per cent of decrease....	.....	12.1	72.4	28.6	58.3	60.7	20.0	50.0	61.9	25.8	70.0
39 Swampy or subject to overflow, 1920....acres..	.....	.....	6,451	4,628	4,532	27,065	.....	5,500	13,300	.....	1,664
40 Swampy or subject to overflow prior to drainage....acres..	1,477	35,787	110,989	23,137	82,001	131,858	3,564	15,400	57,200	35,220	12,478
41 Decrease since drainage....acres..	1,477	35,787	104,538	18,509	77,469	104,793	3,564	9,900	43,900	35,220	10,814
42 Per cent of decrease....	100.0	100.0	94.2	80.0	94.5	79.5	100.0	64.3	76.7	100.0	86.7
CAPITAL INVESTED AND COST PER ACRE.											
43 Total capital invested in and required for completion of operating enterprises....dollars..	45,000	176,000	453,452	92,000	157,500	675,824	158,429	24,600	215,880	83,000	50,000
44 Capital invested in these enterprises to Dec. 31, 1919....dollars..	45,000	176,000	453,452	92,000	157,500	675,824	158,429	24,600	215,880	83,000	50,000
45 Additional capital required to complete these enterprises....dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
46 Average cost per acre when completed....dollars..	30.47	0.49	3.29	1.99	1.73	3.03	6.67	1.12	1.62	1.75	3.01
47 Enterprises constructing open ditches only....dollars..	.....	.....	380,452	92,000	157,500	382,824	158,429	.....	215,880	83,000	50,000
48 Average cost per acre when completed....dollars..	.....	.....	3.31	1.99	1.73	3.16	6.67	.....	1.62	1.75	3.01
49 Enterprises constructing open ditches and levees....dollars..	45,000	176,000	73,000	.....	.....	293,000	.....	24,600	.....	.....	.....
50 Average cost per acre when completed....dollars..	30.47	0.49	3.17	.....	.....	2.86	.....	1.12	.....	.....	.....
CROPS.											
Improved land in enterprises reporting—											
51 Corn as principal crop on drained land....acres..	.....	.....	16,084	.....	38,610	109,709	.....	.....	102,750	.....	14,141
52 Cotton as principal crop on drained land....acres..	977	.....	80,181	.....	.....	45,890	9,505	.....	.....	17,664	.....
53 Vegetables as principal crop on drained land....acres..	.....	98,723	.....	.....	.....	.....	.....	.....	.....	.....	.....
54 Alfalfa as principal crop on drained land....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
55 Other crops as principal ones on drained land....acres..	.....	.....	.....	20,824	19,253	11,619	.....	6,600	.....	.....	.....

[1] Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.
[2] When works under construction have been completed.
[3] The reported figures have been reduced by the same acreage as the improved land, 1920.

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FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT OF COMMERCE

BULLETIN

BUREAU OF THE CENSUS
SAM. L. ROGERS, DIRECTOR

DRAINAGE : UTAH

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

INTRODUCTION.

This bulletin presents the statistics of drainage for Utah collected at the census of 1920. The figures relate to conditions as of January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of unimproved land not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner constructs on his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are shown separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

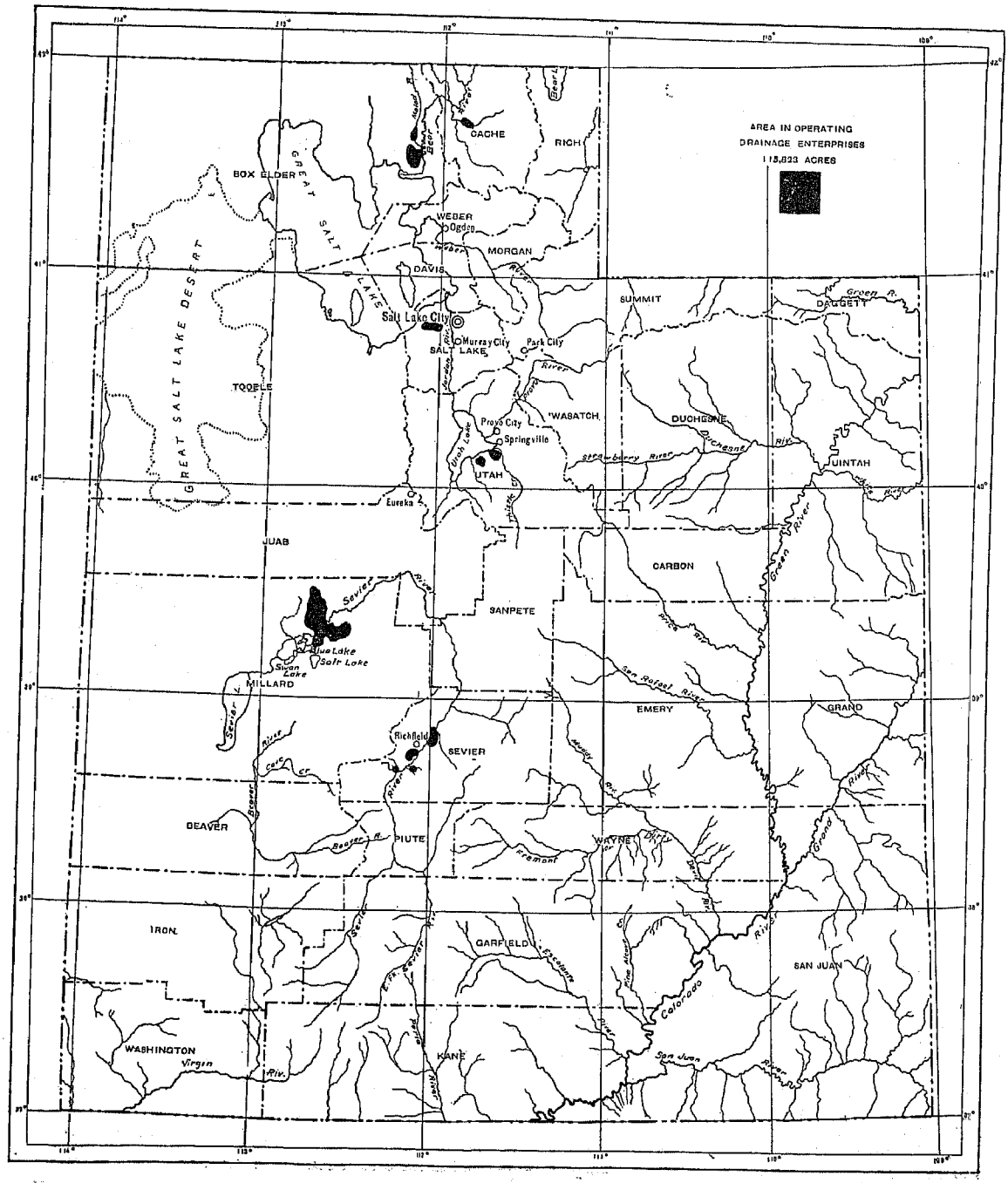
ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state	25,662	100.0
Farms reporting land having drainage	2,729	10.6
Farms reporting land needing drainage	3,085	12.0
All land in farms—acres	5,050,410	100.0
Improved land in farms—acres	1,715,380	34.0
Farm land reported as provided with drainage—acres	74,316	1.5
Farm land reported as needing drainage—acres	165,926	3.3
DRAINAGE ENTERPRISES.		
Approximate land area of the state—acres	52,597,760	100.0
All land in operating drainage enterprises—acres	113,823	0.2
Improved land—acres	97,314	0.2
Unimproved land [1]—acres	16,509	(2)
Capital invested in and required for completion of operating enterprises	$2,870,773	100.0
Capital invested in these enterprises to Dec. 31, 1919	$1,005,473	35.0
Additional capital required to complete these enterprises	$1,865,300	65.0

[1] No timber or cut-over land reported.

[2] Less than one tenth of 1 per cent.

UTAH

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purposes of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual?" Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swampy or overflowed lands for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those drainage enterprises that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (*a*) improved land; (*b*) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprise.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops, which suffers damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago, but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by decree of the county commissioners and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL.[1]		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All organized enterprises	134,554	100.0	$1,014,973	100.0	$2,512,800
Operating enterprises	113,823	84.6	1,005,473	99.1	1,865,300
With works completed	23,993	17.8	495,007	48.8	
With works under construction	89,830	66.8	510,466	50.3	1,865,300
Nonoperating enterprises	20,731	15.4	9,500	0.9	647,500

[1] The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—All of the drainage enterprises in Utah lie in the central and north central part of the state, and all are within the rim of the Great Basin.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All organized enterprises	134,554	100.0	$1,014,973	100.0	$2,512,800
Operating enterprises	113,823	84.6	1,005,473	99.1	1,865,300
Sevier River	88,281	65.6	641,973	63.3	1,720,300
Great Salt Lake	25,542	19.0	363,500	35.8	145,000
Nonoperating enterprises	20,731	15.4	9,500	0.9	647,500
Sevier River	14,872	11.1	7,500	0.7	492,500
Great Salt Lake	5,859	4.3	2,000	0.2	155,000

Condition of land in enterprises.—The enterprises have been organized almost entirely to drain and protect lands injured or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation.

For the state, 275 acres of irrigated land in drainage enterprises are reported as not having needed drainage but as having been included and assessed merely as being responsible for damage to the other lands.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises	113,823	100.0	23,993	89,830	20,731
Improved land	97,314	85.5	18,249	78,965	17,676
Unimproved land[1]	16,509	14.5	5,644	10,865	3,055
Swampy, seeped, or alkali	88,181	77.5	6,476	81,705	20,309
Suffering a loss of crops	76,803	67.5	2,277	74,526	17,398

[1] No timber or cut-over land reported.

Size of enterprises.—The average area included in the 17 operating drainage enterprises in Utah is 6,695 acres; only 3 of them comprise as much as 10,000 acres each. The average area in the 6 nonoperating enterprises is 3,455 acres. None of the enterprises embraces land in more than one county, and there is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises	113,823	113,823	100.0
500 to 999 acres	1,749	1,749	1.5
1,000 to 4,999 acres	29,104	29,104	25.6
5,000 to 9,999 acres	5,280	5,280	4.6
10,000 to 49,999 acres	77,690	77,690	68.3

Character of enterprises.—All the drainage enterprises in Utah, except commercial and private undertakings, are operating now (Jan. 1, 1920) under the

only general drainage law of the state. This is chapter 41, approved March 19, 1919, which was made applicable to all drainage districts formed under earlier laws.

This law provides for the establishment of drainage districts by the board of county commissioners, upon petition from a majority of the owners of land in the proposed district who must own at least one-third of the acreage to be affected, or from not less than one-third of the owners who must hold a majority of the acreage. The drainage works are laid out, constructed, and maintained by a board of supervisors consisting of three competent persons appointed by the county commissioners. The cost of the enterprise is apportioned against the tracts of land in the district by the supervisors, in proportion to the benefits each will receive, proper allowance being made also for any damages that will be caused. The supervisors report annually to the commissioners concerning all work done, all money collected, and all expenditures made; they also report semiannually at meetings of the residents of the district, during the progress of construction. For a district comprising land in more than one county, proceedings are held in that county in which the greatest portion is situated. No land in one drainage district may be included in a second district without the consent of the board of supervisors of the first district.

The petition must describe the boundaries of the district and state the general plan of drainage. The boundaries may be amended by the county commissioners when, after public hearing upon the petition, they establish the district and appoint the supervisors. Investigation is made by the supervisors, who then report to the commissioners regarding the practicability of the enterprise. If they report that the total cost will exceed the benefits, the district is abandoned at the cost of the petitioners. If they report favorably, the district boundaries are fixed by the commissioners, after public hearing if additional lands are included except by consent of the owners of those lands. The apportionment of costs is equalized and confirmed by the county commissioners, after hearing all complaints regarding the assessments. The supervisors may issue bonds to pay for the construction work, running not less than 5 nor more than 40 years, if the issue is approved by vote of the landowners in the district.

The first general drainage law of this state was that of April 16, 1896 (ch. 132), authorizing the establishment of drainage districts upon petition from 50 or more persons, constituting a majority of the owners of the lands to be affected. The districts were to be controlled by 3 or 5 directors elected by the freeholders of the district; the costs were to be paid by an assessment spread uniformly upon all the lands in the district. This law was amended March 14, 1907 (ch. 108), to require that the petition need be signed by only a majority of the owners holding title to a major part of the land, and to apportion the cost in proportion to the benefits. The supreme court of Utah declared this law unconstitutional, in 1911, because it did not provide opportunity for the land-owners to show that their lands would not be benefited or were not assessed equitably. The main provisions of the law of March 21, 1913 (ch. 95), which was amended March 22, 1915 (ch. 114), were similar to those of the present law.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount	Per cent of total.	Additional required to complete.
All organized enterprises...	134,554	100.0	$1,014,973	100.0	$2,512,800
Operating enterprises.....	113,823	84.6	1,005,473	99.1	1,865,300
Drainage districts.....	105,519	78.4	776,516	76.5	1,865,300
Laws of 1907, ch. 108.....	750	0.6	3,500	0.3	.....
Laws of 1913, ch. 95.....	102,341	76.0	708,016	69.8	1,813,300
Laws of 1919, ch. 41.....	2,428	1.8	65,000	6.4	52,000
Commercial developments[1]....	8,304	6.2	228,957	22.6	.....
Nonoperating enterprises.....	20,731	15.4	9,500	0.9	647,500
Drainage districts.....	20,731	15.4	9,500	0.9	647,500
Laws of 1913, ch. 95.....	16,219	12.0	7,000	0.7	460,000
Laws of 1919, ch. 41.....	4,512	3.4	2,500	0.2	187,500

[1] Includes 1,050 acres under individual ownership.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 120.3 miles of open ditches, 599.1 miles of tile drains, and 2 miles of accessory levees; the additional lengths under construction were 4.5 miles of open ditches and 777.6 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the drainage enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. Some of the districts, however, are installing drainage systems planned in such detail as is intended to accomplish complete drainage of the lands without requiring any supplemental drains to be installed by the individual land-owners. Pumping is used for draining only 1,400 acres in drainage enterprises in Utah, and then only part time, in seasons of flood.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All kinds.....	113,823	100.0	$1,005,473	100.0	$1,865,300
Open ditches only.....	1,050	0.9	10,000	1.0	.....
Tile drains only.....	4,321	3.8	113,550	11.3	27,500
Open ditches and tile drains[1]...	108,452	95.3	881,923	87.7	1,837,800

[1] Includes 2,700 acres having open ditches, tile drains, and levees.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises	113,823	100.0
3.0 to 3.9 feet	1,050	0.9
4.0 to 4.9 feet	13,590	11.9
5.0 to 5.9 feet	4,554	4.0
6.0 to 6.9 feet	79,210	69.6
7.0 to 7.9 feet	3,022	2.7
Not reporting branch ditches	12,397	10.9

Maintenance of works.—The first drainage law of Utah (1896) authorized the levy of taxes in a drainage district for maintenance purposes. The present law (1919) repeats the provision in earlier laws that the board of supervisors shall make annually an estimate of the money to be raised in the district, including the expense of maintaining the drains and other works, which is levied against the land in proportion to the benefits to the various tracts. The drainage districts that have completed construction report that the drains are maintained systematically by district forces, except for one small district which reports that the drains are not being maintained.

Date of organization.—The progress of development in the drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed. No drainage enterprises were reported as organized in Utah earlier than 1907.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		ASSESSED AREA.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises	113,823	100.0	113,823	100.0
1905–1909	750	0.7	750	0.7
1910–1914	9,380	8.2	9,380	8.2
1915–1919	103,693	91.1	103,693	91.1

TABLE 10.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises	$1,005,473	100.0	$1,865,300
1905–1909	3,500	0.3	.....
1910–1914	120,000	12.0	150,000
1915–1919	881,973	87.7	1,715,300

TABLE 11.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees	124.8	100.0	1,376.7	100.0	2.0	100.0
1905–1909	.....	.....	0.6	0.1	.....	.....
1910–1914	15.2	12.2	63.5	4.6	.....	.....
1915–1919	109.6	87.8	1,312.6	95.3	2.0	100.0

Crops.—The principal crops grown upon the drained land in drainage enterprises are alfalfa, sugar beets, grain, and hay other than alfalfa. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Box Elder.	Cache.	Carbon.	Davis.	Duchesne.	Juab.
1	Number of all farms in the state or county	25,662	1,859	2,242	235	1,172	1,248	419
2	Farms reporting land having drainage	2,729	502	164	12	338	16	14
3	Farms reporting land needing drainage	3,085	174	198	19	206	254	11
4	Farms in drainage and levee districts	791	151	43	.....	8	14	.....
	LAND AND FARM AREA.							
5	Approximate land area of the state or county—acres	52,597,760	3,484,160	744,960	951,680	176,000	2,090,240	2,176,640
6	All land in farms—acres	5,050,410	542,348	317,698	35,899	98,732	252,031	105,741
7	Improved land in farms—acres	1,715,380	219,657	183,654	12,117	52,029	96,697	49,751
8	Woodland in farms—acres	212,762	11,047	25,373	2,312	6,320	12,006	3,659
9	Other unimproved land in farms—acres	3,122,268	311,644	108,671	21,470	40,383	143,328	52,331
10	Farm land reported as provided with drainage—acres	74,316	24,342	3,541	877	5,816	803	873
11	Farm land reported as needing drainage—acres	165,920	20,153	3,854	617	5,502	9,738	541
12	Drainage only—acres	74,786	17,880	3,671	128	5,328	5,988	231
13	Drainage and clearing—acres	91,140	2,273	183	489	174	3,750	310

		Millard.	Salt Lake.	Sanpete.	Sevier.	Summit.	Utah.	Weber.	All other counties.[1]
1	Number of all farms in the county	1,038	2,438	1,813	1,108	521	3,237	1,687	6,645
2	Farms reporting land having drainage	86	254	70	239	12	506	436	80
3	Farms reporting land needing drainage	102	245	200	113	128	444	329	662
4	Farms in drainage and levee districts	57	94	35	187	1	127	57	17
	LAND AND FARM AREA.								
5	Approximate land area of the county—acres	4,199,040	483,840	1,034,240	1,265,920	1,196,800	1,301,760	346,240	33,146,240
6	All land in farms—acres	185,197	317,281	391,007	113,005	271,778	318,133	259,566	1,841,994
7	Improved land in farms—acres	91,685	92,447	138,552	66,960	38,807	135,996	66,855	470,173
8	Woodland in farms—acres	1,502	24,913	12,154	2,808	26,266	7,043	12,924	64,435
9	Other unimproved land in farms—acres	92,010	199,921	240,301	43,237	206,705	175,094	179,787	1,307,386
10	Farm land reported as provided with drainage—acres	5,274	3,483	785	7,822	768	10,076	7,266	2,590
11	Farm land reported as needing drainage—acres	8,714	9,677	7,540	4,110	3,821	10,738	8,091	72,830
12	Drainage only—acres	4,493	3,630	6,089	3,946	761	8,656	4,434	9,551
13	Drainage and clearing—acres	4,221	6,047	1,451	164	3,060	2,082	3,657	63,279

[1] No drainage reported in Grand, Piute, Rich, and Wayne Counties.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Box Elder.	Millard.	Salt Lake.	Sevier.	Other counties.[1]
	LAND AREA.						
1	Approximate land area of the state or county.....acres..	52,597,760	3,484,160	4,199,040	483,840	1,265,920	2,046,720
2	All land in operating drainage enterprises.....acres..	113,823	12,690	76,634	4,080	11,647	8,772
3	Improved land.....acres..	97,314	7,245	76,634	200	6,485	6,750
4	Per cent of all improved land in farms.....	5.7	3.3	83.5	0.2	9.7	2.1
5	Unimproved land [2].....acres..	16,509	5,445	.....	3,880	5,162	2,022
6	Swampy, seeped, or alkali land in enterprises.....acres..	88,181	4,000	74,357	3,880	3,022	2,922
7	Suffering loss of crops from defective drainage.....acres..	76,803	.....	74,357	200	1,246	1,000
8	Assessed acreage.....	113,823	12,690	76,634	4,080	11,647	8,772
9	Excess over all land in enterprises.....acres..	.....	.....	.....	.....	.....	.....
	DRAINAGE WORKS.						
	Open ditches:						
10	Completed.....miles..	120.3	15.0	89.6	0.5	1.2	14.0
11	Additional under construction.....miles..	4.5	.....	.....	4.5	.....	.....
12	Maximum completed in any enterprise.....miles..	58.8	8.0	58.8	0.5	1.0	7.0
13	Maximum width at bottom of ditch [3].....feet..	24	20	24	12	6	8
14	Maximum of average depths of outlet ditches [3].....feet..	15	15	7	3.5	6	7
15	Mean depth of branch ditches [3].....feet..	5.7	3.9	5.9	6.0	.....	5.7
	Tile drains:						
16	Completed.....miles..	599.1	206.6	237.0	.....	81.5	74.0
17	Additional under construction.....miles..	777.6	.....	653.0	55.0	38.1	31.5
18	Maximum completed in any enterprise.....miles..	206.0	206.0	92.0	.....	42.0	.....
19	Maximum size of tile [3].....inches..	24	18	20	.....	24	.....
	Accessory levees and dikes:						
20	Completed.....miles..	2.0	.....	.....	.....	.....	2.0
21	Additional under construction.....miles..	.....	.....	.....	.....	.....	.....
	Area drained by open ditches only [3].....acres..	1,050	1,050	.....	.....	.....	.....
23	Length of these ditches.....miles..	7.0	7.0	.....	.....	.....	.....
24	Average length per acre.....feet..	35.2	35.2	.....	.....	.....	.....
25	Area drained by tile only [3].....acres..	4,321	750	.....	.....	3,571	.....
26	Length of these tile.....miles..	38.2	0.6	.....	.....	37.6	.....
27	Average length per acre.....feet..	46.7	4.2	.....	.....	55.0	.....
28	Area drained by open ditches and tile [3].....acres..	[4] 108,452	10,890	76,634	4,080	8,076	[4] 8,772
29	Length of these ditches and tile.....miles..	1,456.3	214.0	970.6	5.0	83.2	174.5
30	Average length per acre.....feet..	70.9	103.8	67.5	6.5	54.4	151.7
31	Length of the accessory levees.....miles..	2.0	.....	.....	.....	.....	2.0
	DEVELOPMENT OF LANDS.						
32	Improved land, 1920.....acres..	97,314	7,245	76,634	200	6,485	6,750
33	Improved land prior to drainage.....acres..	89,394	2,889	76,634	200	6,351	3,320
34	Increase since drainage.....acres..	7,920	4,356	.....	.....	134	3,430
35	Per cent of increase.....	8.8	150.7	.....	.....	2.1	103.3
36	Per cent increase is of all improved land in farms, 1920.....	0.5	2.0	.....	.....	0.2	1.1
37	Unimproved land, 1920 [2].....acres..	16,509	5,445	.....	3,880	5,162	2,022
38	Unimproved land prior to drainage [2].....acres..	24,429	9,801	.....	3,880	5,296	5,452
39	Decrease since drainage.....acres..	7,920	4,356	.....	.....	134	3,430
40	Per cent of decrease.....	32.4	44.4	.....	.....	2.5	62.9
41	Swampy, seeped, or alkali land, 1920.....acres..	88,181	4,000	74,357	3,880	3,022	2,922
42	Swampy, seeped, or alkali land prior to drainage.....acres..	104,592	9,800	76,634	3,880	5,776	8,502
43	Decrease since drainage.....acres..	16,411	5,800	2,277	.....	1,854	6,480
44	Per cent of decrease.....	15.7	59.2	3.0	.....	32.1	76.2
	CAPITAL INVESTED AND COST PER ACRE.						
45	Total capital invested in and required for completion of operating enterprises.....dollars..	2,870,773	188,500	2,028,957	80,000	333,316	240,000
46	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	1,005,473	188,500	428,157	5,000	213,816	170,000
47	Additional capital required to complete these enterprises.....dollars..	1,865,300	.....	1,600,800	75,000	119,500	70,000
48	Average cost per acre when completed.....dollars..	25.22	14.85	26.48	19.61	28.62	27.36
49	Enterprises constructing open ditches only.....dollars..	10,000	10,000	.....	.....	.....	.....
50	Average cost per acre when completed.....dollars..	9.52	9.52	.....	.....	.....	.....
51	Enterprises constructing tile drains only.....dollars..	141,050	3,500	.....	.....	.....	.....
52	Average cost per acre when completed.....dollars..	32.64	4.67	.....	.....	137,550	.....
53	Enterprises constructing open ditches and tile drains.....dollars..	[5] 2,719,723	175,000	2,028,957	80,000	38.52	.....
54	Average cost per acre when completed.....dollars..	25.08	16.07	26.48	19.61	195,766	[5] 240,000
						24.24	27.36
	CROPS.						
	Improved land in enterprises reporting:						
55	Alfalfa as principal crop on drained land.....acres..	80,884	.....	76,634	200	.....	4,050
56	Sugar beets as principal crop on drained land.....acres..	14,630	5,445	.....	.....	6,485	2,700
57	Other crops as principal ones on drained land.....acres..	1,800	1,800	.....	.....	.....	.....

[1] Includes only Cache and Utah Counties.
[2] No timber or cut-over land reported.
[3] When works under construction have been completed.
[4] Includes 2,700 acres having open ditches, tile drains, and levees.
[5] Includes cost of 2 miles of accessory levees.

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FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT OF COMMERCE

BULLETIN

BUREAU OF THE CENSUS
SAM. L. ROGERS, DIRECTOR

DRAINAGE : WASHINGTON

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

INTRODUCTION.

This bulletin presents the statistics of drainage for Washington collected at the census of 1920. The figures relate to conditions as of January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of unimproved land not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner constructs on his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

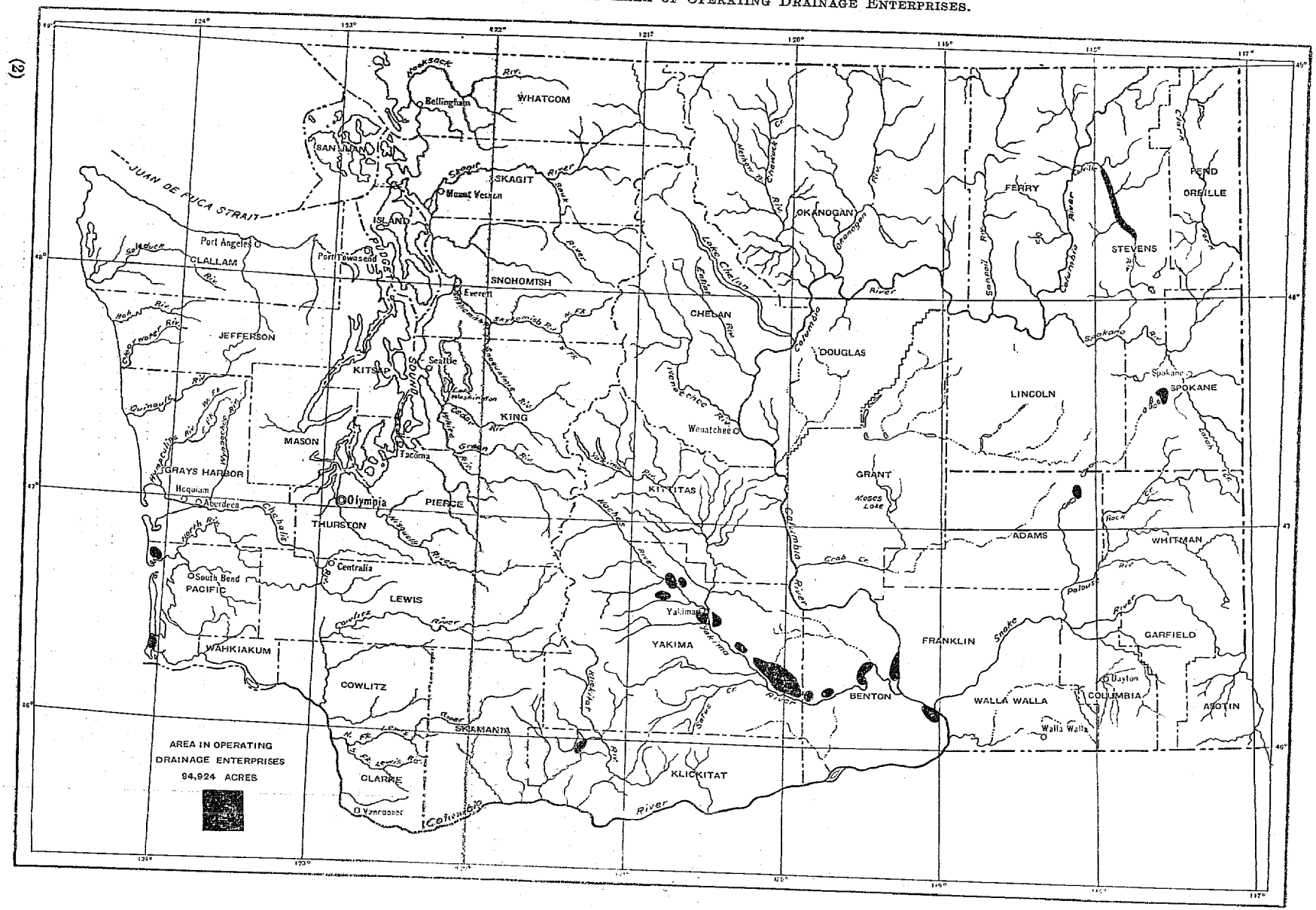
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state	66,288	100.0
Farms reporting land having drainage	10,020	15.1
Farms reporting land needing drainage	14,323	21.6
All land in farms—acres	13,244,720	100.0
Improved land in farms—acres	7,129,343	53.8
Farm land reported as provided with drainage—acres	274,696	2.1
Farm land reported as needing drainage—acres	576,005	4.3
DRAINAGE ENTERPRISES.		
Approximate land area of the state—acres	42,775,040	100.0
All land in operating drainage enterprises—acres	94,924	0.2
Improved land—acres	81,886	0.2
Timber and cut-over land—acres	850	(1)
Other unimproved land—acres	12,188	(1)
Capital invested in and required for completion of operating enterprises	$1,436,419	100.0
Capital invested in these enterprises to Dec. 31, 1919	$1,397,419	97.3
Additional capital required to complete these enterprises	$39,000	2.7

[1] Less than one-tenth of 1 per cent.

WASHINGTON

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, includes the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual?" Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, any other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those drainage enterprises that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (*a*) improved land; (*b*) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (*c*) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, lands subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only lands devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These include both those which have completed their drainage works and those with such works under construction. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to finance the undertakings, and let contracts for the construction work, and also districts for which decree of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL.[1]		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All organized enterprises	99,789	100.0	$1,442,419	100.0	$114,000
Operating enterprises	94,924	95.1	1,397,419	96.9	39,000
With works completed	90,084	90.3	1,376,809	95.5	.....
With works under construction	4,840	4.8	20,610	1.4	39,000
Nonoperating enterprises	4,865	4.9	45,000	3.1	75,000

[1] The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The great part of the drainage enterprises lies in the Yakima Valley, in the south central part of the state, though there are some enterprises to drain lands subject to overflow along Clark Fork and Colville River in the northeast corner and a very few to drain wet and swampy lands in the south and southwest parts of the state. There are no drainage enterprises in the region tributary to Puget Sound.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All organized enterprises	99,789	100.0	$1,442,419	100.0	$114,000
Operating enterprises	94,924	95.1	1,397,419	96.9	39,000
Pacific Ocean	4,200	4.2	37,044	2.6	10,000
Columbia River and Snake River	30,965	31.0	336,500	23.3	.....
Yakima River	59,759	59.9	1,023,875	71.0	29,000
Nonoperating enterprises	4,865	4.9	45,000	3.1	75,000
Yakima River	4,865	4.9	45,000	3.1	75,000

Condition of land in enterprises.—All the enterprises in Benton and Yakima Counties are within the boundaries of the United States Reclamation Service projects. They are for the drainage and protection of lands injured or threatened with seepage and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation.

In Benton County, 5,800 acres of irrigated land in drainage enterprises are reported as not having needed drainage, but as having been included and assessed merely as responsible for damage to the other lands.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises	94,924	100.0	90,084	4,840	4,865
Improved land	81,886	86.3	78,271	3,615	3,174
Timber and cut-over land	850	0.9	250	600	.....
Other unimproved land	12,188	12.8	11,563	625	1,691
Swampy, seeped, or alkali	10,873	11.5	9,743	1,130	1,416
Suffering a loss of crops	8,996	9.5	7,971	1,025	.....

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 52 operating drainage enterprises are counted in Washington, with an average area of 2,029 acres assessed. Just 26 of them comprise between 1,000 and 5,000 acres each. The assessed acreage exceeds the land in enterprises by 10,553 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprise.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises	94,924	105,477	100.0
Less than 200 acres		322	0.3
200 to 499 acres	822	1,625	1.5
500 to 999 acres	6,830	9,161	8.7
1,000 to 4,999 acres	45,723	52,820	50.1
5,000 to 9,999 acres	19,649	19,649	18.6
10,000 to 49,999 acres	21,900	21,900	20.8

Character of enterprises.—The operating drainage enterprises in Washington are of several kinds varying somewhat in method of formation and in management, while the nonoperating enterprises are all of one kind—drainage improvement districts. The types of drainage enterprises authorized by the laws of this state are as follows:

1. *Drainage districts,* incorporated under chapter 115, laws of 1895 (approved Mar. 20), comprising any portion of a county having five or more inhabitants or freeholders. These districts are established by the county commissioners, upon petition from the owners of a majority of the acreage in the proposed district and after favorable vote by a majority of the qualified voters residing in the proposed district. The executive officers are a board of three elected drainage commissioners, who have exclusive charge of construction and maintenance for all drainage systems within the district. The cost of the enterprise is apportioned against the lands in proportion to the benefits they will receive. A district may be established only if it will be conducive to the public health, welfare, and convenience, will increase the public revenue, will have a sufficient outlet for drainage, and will cost less than the estimated benefits to be derived. The plan of drainage works, estimate of cost, and assessments of damages and of benefits to each landowner are prepared by the drainage commissioners, who submit them to the superior court of the county with petition that the works be constructed. After public hearing upon this petition, the damages and benefits are determined by a jury. Appeal from the jury's awards may be made to the supreme court of the state. The drainage commissioners may issue bonds running 5 to 10 years, upon petition from a majority of the landowners of the district, to cover all costs. Under chapter 117, laws of 1895, diking districts may be established in a very similar manner, with authority by an amendment in 1907 to improve watercourses flowing through or located within the diking district, and to construct all needed and auxiliary ditches necessary to protect the land in the district or to preserve the diking system.

2. *Diking and drainage districts* organized under chapter 225, laws of 1909 (approved Mar. 20), comprising a portion of two or more counties and containing 100 or more inhabitants. Each of these districts is established by the commissioner of public lands of the state and the county commissioners of all the counties in which the proposed district is located, in joint meeting. The petition for establishment must be signed by 100 freeholders in the proposed district, or by a majority of those in each county if the total number is less than 200. The district must be approved by a majority vote in each county, of the qualified electors resident in the district. The executive board of the enterprise consists of five elected district commissioners. The total cost of the project is assessed against the lands in proportion to the special benefits they will receive. No district is to be established unless it will be conducive to the public health, welfare, and convenience, will increase the public revenue, and will be of benefit to the majority of the land included. The plan of drainage works and the assessment against the lands are made by the district commissioners. Public hearing is held before the assessments are confirmed for collection by the county treasurer. Appeal from any assessment may be taken to the superior court of the county and thence to the supreme court of the state. The district board constructs the works required for the purpose of the district, executing all necessary contracts. They may issue bonds for not exceeding 10 years, subject to annual call.

3. *Drainage improvement districts* established under chapter 66, laws of 1901 (approved Mar. 8), and chapter 176, laws of 1913 (approved Mar. 24), when the landowners do not wish to incorporate as a drainage district under chapter 115, laws of 1895, or are too few to organize under that law. Such enterprises are established by the board of county commissioners upon petition from one or more landowners to be affected, if the county engineer reports that the proposed work is feasible. The county commissioners are the executive board of all drainage improvement districts in the county. The cost of the enterprise is distributed against all properties benefited, including cities, towns, and irrigation systems, in proportion to the benefits to each. The drainage plan, cost estimate, and schedule of property that will be damaged are made by the county engineer. These may be modified at public hearing by the commissioners, who then have the drainage works constructed, or dismiss the proceedings if the benefits to be secured will not warrant the undertaking. If the award of damages is not accepted by any property owner, condemnation proceedings are instituted in the superior court. The county engineer and two elected landowners are a board of supervisors in charge of construction and maintenance of the works, but the commissioners may let contract for the construction. After construction is completed, the cost of the enterprise is apportioned against the properties benefited, by the county engineer and two other appraisers appointed by the commissioners. This apportionment must be considered at a public hearing before being finally adopted. For a district located in more than one county, the petition for establishment is submitted to the commissioners of each county; the county engineers examine the project together but report separately for their respective counties; the hearings are held and contracts are let jointly by the boards of county commissioners. The law of 1901 was repealed by that of 1913, and all enterprises established under the earlier statute were brought under the later one, except for contracts let and work in progress.

4. *Local improvement districts* within irrigation districts, organized under chapter 162, laws of 1917 (approved Mar. 16), for drainage or other local improvements. These are established by the directors of the irrigation district, upon petition from the holders of title to one-fourth the acreage proposed to be assessed. The directors of the irrigation district are the officers of the local improvement district. The cost of the special improvements is assessed against the lands in proportion to the benefits to be conferred. The petition for establishing the local improvement district may be dismissed if the directors find the proposed work inexpedient; it must be dismissed if it is opposed by the majority of holders of title in the proposed district. The assessment, equalization, levy, and collection of assessments is made for the local improvement district in like manner as for irrigation district purposes, except that no election is required to authorize the improvements.

5. *Private ditches* established by the county commissioners, under chapter 125, laws of 1899 (approved Mar. 14), when land is so situated that the owner can not secure drainage except across the land of other owners who refuse permission. Petition is made to the superior court of the county, which appoints the county surveyor and two other viewers to report regarding the necessity for the drain

and the damages to be paid to each defendant owner. The court gives notice of hearing upon the report and determines whether the ditch shall be established and the amounts of damages, which must be paid by the petitioners within 20 days and before beginning construction. The defendants may appeal from the court's decision as in other civil cases. Chapter 133, laws of 1913 (approved Mar. 20), provides for securing a private way of necessity for drains, roads, or other improvements by one owner across the lands of another by proceedings the same as the statutes provide for condemnation of private property by railroad companies.

The many amendments to the drainage laws enumerated, dealing with the details of procedure, powers of officials, extension and abandonment of drainage enterprises, are not mentioned herein and do not affect the types of organization as described above. All state, school, and granted lands are subject to assessment for drainage improvements like other lands.

Washington Territory was organized in 1854, and was admitted as a state in 1889. In 1858 a law was passed generally similar to that of 1899 for establishing private ditches. Acts of 1875 and 1883 were somewhat similar to the act of 1913 for drainage improvement districts. The first state legislature enacted a drainage law (approved Mar. 19, 1890) generally similar to that of 1913 authorizing drainage improvement districts. This was declared unconstitutional by the supreme court of the state in 1893 and 1894, as providing for taking private property without just compensation.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All organized enterprises	99,789	100.0	$1,442,419	100.0	$114,000
Operating enterprises	94,924	95.1	1,397,419	96.9	39,000
Drainage districts	23,100	23.1	161,634	11.2	.....
Diking and drainage districts	5,000	5.0	48,500	3.4	.....
Drainage improvement districts	66,824	67.0	1,187,285	82.3	39,000
Law of 1901	31,991	32.1	342,194	23.7	.....
Law of 1913 [1]	34,833	34.9	845,091	58.6	39,000
Nonoperating enterprises	4,865	4.9	45,000	3.1	75,000
Drainage improvement districts	4,865	4.9	45,000	3.1	75,000

[1] Includes 1,100 acres under individual ownership.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 162.4 miles of open ditches and 83 miles of tile drains. The additional lengths under construction were 7.4 miles of open ditches, 0.7 mile of tile drains, and 1 mile of accessory levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts among the operating drainage enterprises in Washington, though there are 2,745 acres in nonoperating enterprises that will be drained, according to the plans, partly by gravity and partly by pumping.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All kinds	94,924	100.0	$1,397,419	100.0	$39,000
Open ditches only [1]	64,405	67.8	592,445	42.4	12,000
Open ditches and tile drains	25,147	26.5	612,659	43.8	27,000
Tile drains only	5,372	5.7	192,315	13.8	.....

[1] Includes 1,000 acres that will have open ditches and levees.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would show the mean depth for the state 5.3 instead of 5.4 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises	94,924	100.0
Less than 3 feet	553	0.6
3.0 to 3.9 feet	7,358	7.7
4.0 to 4.9 feet	9,263	9.8
5.0 to 5.9 feet	13,147	13.7
6.0 to 6.9 feet	23,523	24.9
7.0 to 7.9 feet	10,262	10.8
Not reporting branches	30,818	32.5

Maintenance of works.—The commissioners of the drainage districts are required by law to make an estimate each year of the expense for maintenance and repair of the drainage system during the succeeding year, which is assessed against the lands in the district in like proportion as the original assessment of

benefits. The commissioners of diking and drainage districts are required to levy an annual tax upon all the property in the district for maintenance of the improvement works, to be levied and collected in like manner as provided by law for levying and collecting school district taxes. The supervisors of drainage improvement districts must make annually an estimate of maintenance expenses, from which the county commissioners levy the assessment apportioned in the same manner as that to pay the cost of construction, though the basis of apportionment may be changed by the commissioners upon petition and after public hearing. The works of each local improvement district are kept in repair by the directors of the irrigation district the same as the irrigation works, but the expenses are paid from the operation and maintenance fund of that local improvement district, which is provided by special assessment against the lands in the local improvement district. No maintenance was reported for some completed districts established under laws requiring the officials to keep the drains in repair. Possibly this is due to the construction work being completed so recently that no expenses have been incurred for repair work.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All operating enterprises	94,924	100.0	$1,397,419	100.0	$39,000
By district forces	85,859	90.5	1,224,419	87.6	39,000
No maintenance provided [1]	9,065	9.5	173,000	12.4	.....

[1] Includes 1,100 acres maintained by landowners.

Date of organization.—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed. No drainage enterprises were reported as organized in Washington earlier than 1900.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises	94,924	100.0	105,477	100.0
1900–1904	3,200	3.4	3,200	3.0
1905–1909	39,966	42.1	39,966	37.9
1910–1914	30,761	32.4	35,304	33.5
1915–1919	14,497	15.3	20,507	19.4
Not reported	6,500	6.8	6,500	6.2

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises	$1,397,419	100.0	$39,000
1900–1904	26,634	1.9	.....
1905–1909	352,850	25.2	.....
1910–1914	594,037	42.6	.....
1915–1919	382,998	27.4	39,000
Not reported	40,000	2.9	.....

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees	169.8	100.0	83.7	100.0	1.0	100.0
1900–1904	4.5	2.7	.....	.....	.....	.....
1905–1909	65.8	38.8	6.0	7.2	.....	.....
1910–1914	68.5	40.3	38.9	46.5	.....	.....
1915–1919	26.0	15.3	38.8	46.3	1.0	100.0
Not reported	5.0	2.9	.....	.....	.....	.....

Crops.—The principal crops grown upon the drained land in drainage enterprises are alfalfa, hay other than alfalfa, and wheat. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE 1.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adams.	Chelan.	Clallam.	Clarke.	Cowlitz.	Grant.	Grays Harbor.
1	Number of all farms in the state or county	66,288	1,084	2,095	607	3,066	1,066	1,110	1,064
2	Farms reporting land having drainage	10,020	2	42	167	275	89	6	93
3	Farms reporting land needing drainage	14,323	2	116	337	880	587	10	245
4	Farms in drainage and levee districts	2,680	4	11	2	26	56	1	5
	LAND AND FARM AREA.								
5	Approximate land area of the state or county—acres	42,775,040	1,223,680	1,856,000	1,104,640	405,760	737,920	1,740,800	1,196,160
6	All land in farms—acres	13,244,720	938,395	235,621	58,043	194,309	110,259	743,518	94,767
7	Improved land in farms—acres	7,129,343	727,876	65,810	20,132	75,073	27,994	413,758	28,793
8	Woodland in farms—acres	1,813,061	2,243	55,817	29,776	66,974	46,604	6,305	43,402
9	Other unimproved land in farms—acres	4,302,316	208,276	113,994	8,135	51,602	35,661	323,455	22,567
10	Farm land reported as provided with drainage—acres	274,696	1,260	947	3,563	5,035	5,179	815	1,578
11	Farm land reported as needing drainage—acres	576,005	235	3,836	18,799	37,875	28,457	855	10,060
12	Drainage only—acres	45,206	105	348	1,838	2,065	2,320	550	1,344
13	Drainage and clearing—acres	530,799	130	3,488	16,961	35,810	26,137	305	8,716

		Island.	Jefferson.	King.	Kitsap.	Kittitas.	Klickitat.	Lewis.	Lincoln.
1	Number of all farms in the county	763	348	3,801	1,535	928	1,177	3,030	1,860
2	Farms reporting land having drainage	271	92	1,048	541	129	45	653	33
3	Farms reporting land needing drainage	296	118	1,156	612	196	89	1,261	38
4	Farms in drainage and levee districts	53	4	102	44	2	23	24	7
	LAND AND FARM AREA.								
5	Approximate land area of the county—acres	133,120	1,155,200	1,351,040	237,440	1,490,560	1,108,000	1,516,160	1,473,280
6	All land in farms—acres	51,932	35,917	151,562	43,885	215,918	562,331	226,162	1,320,405
7	Improved land in farms—acres	17,127	8,457	68,272	13,411	95,984	190,616	79,322	832,678
8	Woodland in farms—acres	25,868	17,903	47,391	22,856	36,074	89,044	89,281	64,578
9	Other unimproved land in farms—acres	8,937	9,557	35,899	7,618	83,860	282,671	57,559	432,149
10	Farm land reported as provided with drainage—acres	6,791	3,218	20,177	3,259	4,027	3,950	16,838	1,805
11	Farm land reported as needing drainage—acres	11,183	10,728	29,206	8,547	10,274	5,141	54,323	2,519
12	Drainage only—acres	2,379	758	3,537	798	1,881	1,211	2,055	1,358
13	Drainage and clearing—acres	8,804	9,970	25,669	7,749	8,393	3,930	52,268	1,161

		Mason.	Okanogan.	Pacific.	Pend Oreille.	Pierce.	San Juan.	Skagit.	Snohomish.
1	Number of all farms in the county	483	2,856	453	586	3,159	535	2,401	3,095
2	Farms reporting land having drainage	115	43	131	75	948	209	849	945
3	Farms reporting land needing drainage	207	321	215	301	1,028	214	615	1,185
4	Farms in drainage and levee districts	.....	2	54	34	142	1	513	240
	LAND AND FARM AREA.								
5	Approximate land area of the county—acres	505,200	3,341,440	572,800	871,040	1,088,640	113,920	1,135,360	1,320,960
6	All land in farms—acres	40,867	689,796	48,804	119,496	118,754	68,513	136,350	151,584
7	Improved land in farms—acres	8,373	212,497	10,509	42,921	41,953	18,922	73,243	53,410
8	Woodland in farms—acres	22,946	113,747	19,058	59,103	40,328	30,859	38,769	53,727
9	Other unimproved land in farms—acres	9,548	363,552	19,237	17,472	36,473	18,732	24,338	44,447
10	Farm land reported as provided with drainage—acres	1,805	907	3,186	2,551	13,323	5,915	37,694	18,539
11	Farm land reported as needing drainage—acres	10,670	15,201	12,874	25,959	21,694	11,870	19,790	32,349
12	Drainage only—acres	504	906	1,627	1,255	2,272	967	2,177	2,625
13	Drainage and clearing—acres	10,166	14,295	11,247	24,704	19,422	10,903	17,613	29,724

		Spokane.	Stevens.	Thurston.	Wahkiakum.	Walla Walla.	Whatcom.	Yakima.	All other counties.[1]
1	Number of all farms in the county	4,830	2,727	1,490	373	1,502	3,369	5,755	9,140
2	Farms reporting land having drainage	295	194	194	128	39	990	1,330	49
3	Farms reporting land needing drainage	658	850	412	129	30	1,861	122	232
4	Farms in drainage and levee districts	30	45	68	86	17	109	875	10
	LAND AND FARM AREA.								
5	Approximate land area of the county—acres	1,123,840	1,603,200	453,760	170,880	809,600	1,332,480	3,237,760	8,214,400
6	All land in farms—acres	811,206	472,490	140,040	33,209	703,251	177,742	479,629	4,060,965
7	Improved land in farms—acres	449,537	139,391	45,963	8,577	474,161	73,673	261,866	2,548,449
8	Woodland in farms—acres	207,468	245,844	48,438	16,294	14,120	56,595	15,224	180,425
9	Other unimproved land in farms—acres	154,201	87,255	45,649	8,338	214,970	47,474	202,539	1,326,091
10	Farm land reported as provided with drainage—acres	16,375	7,685	4,852	3,044	1,468	23,316	54,558	1,036
11	Farm land reported as needing drainage—acres	26,235	73,681	17,728	2,938	546	61,233	2,894	9,305
12	Drainage only—acres	1,689	1,307	2,163	412	251	2,998	912	594
13	Drainage and clearing—acres	23,546	72,374	15,565	2,526	295	58,235	1,982	8,711

[1] No drainage reported in Asotin, Douglas, Franklin, Garfield, and Skamania Counties.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Benton.	Klickitat.	Pacific.	Stevens.	Yakima.	Other counties.[1]
	LAND AREA.							
1	Approximate land area of the state or county....acres..	42,775,040	1,069,440	1,168,000	572,800	1,603,200	3,237,760	2,347,520
2	All land in operating drainage enterprises....acres..	94,924	10,340	4,965	4,200	15,000	55,919	4,500
3	Improved land....acres..	81,886	9,715	4,468	2,960	13,750	47,593	3,400
4	Per cent of all improved land in farms....	1.1	4.8	2.3	28.2	9.9	18.2	0.3
5	Timber and cut-over land....acres..	850	.....	.....	600	250	.....	.....
6	Other unimproved land....acres..	12,188	625	497	640	1,000	8,326	1,100
7	Swampy, seeped, or alkali land in enterprises....acres..	10,873	914	497	640	1,000	7,222	600
[8]	Suffering a loss of crops from defective drainage....acres..	8,996	725	.....	600	938	6,733	.....
9	Assessed acreage....	105,477	10,340	4,965	3,200	15,000	66,472	5,500
10	Excess over all land in operating enterprises....acres..	10,553	.....	.....	.....	.....	10,553	.....
	DRAINAGE WORKS.							
	Open ditches:							
11	Completed....miles..	162.4	7.9	12.0	4.5	26.0	86.5	25.5
12	Additional under construction....miles..	7.4	3.9	.....	.....	.....	.....	3.5
13	Maximum completed in any enterprise....miles..	18.0	3.0	12.0	4.5	18.0	13.9	11.0
14	Maximum width at bottom of ditch [2]....feet..	40	6	30	10	40	5	14
15	Maximum of average depths of outlet ditches [2]....feet..	10.0	7.0	8.0	3.5	9.0	10.0	10.0
16	Mean depth of branch ditches [2]....feet..	5.4	4.5	6.0	3.0	.....	5.6	3.8
	Tile drains:							
17	Completed....miles..	83.0	.....	.....	.....	.....	82.0	1.0
18	Additional under construction....miles..	0.7	0.7	.....	.....	.....	.....	.....
19	Maximum completed in any enterprise....miles..	14.1	.....	.....	.....	.....	14.1	1.0
20	Maximum size of tile [2]....inches..	32	.....	.....	.....	.....	32	8
	Accessory levees and dikes:							
21	Completed....miles..	.....	.....	.....	.....	.....	.....	.....
22	Under construction....miles..	1.0	.....	.....	1.0	.....	.....	.....
23	Area drained by open ditches only [2]....acres..	[3] 64,405	7,890	4,965	[3] 4,200	15,000	28,950	3,400
24	Length of these ditches....miles..	108.9	6.8	12.0	4.5	26.0	41.6	18.0
25	Average length per acre....feet..	8.9	4.6	12.8	5.7	9.2	7.6	28.0
26	Length of accessory levees....miles..	1.0	.....	.....	1.0	.....	.....	.....
27	Area drained by tile only [2]....acres..	5,372	.....	.....	.....	.....	5,372	.....
28	Length of these tile....miles..	28.2	.....	.....	.....	.....	28.2	.....
29	Average length per acre....feet..	27.7	.....	.....	.....	.....	27.7	.....
30	Area drained by both ditches and tile [2]....acres..	25,147	2,450	.....	.....	.....	21,597	1,100
31	Length of these drains....miles..	116.4	5.7	.....	.....	.....	98.7	12.0
32	Average length per acre....feet..	24.4	12.3	.....	.....	.....	24.1	57.6
	DEVELOPMENT OF LANDS.							
33	Improved land in operating enterprises, 1920....acres..	81,886	9,715	4,468	2,960	13,750	47,593	3,400
34	Improved land prior to drainage....acres..	49,748	9,715	497	.....	.....	39,536	.....
35	Increase since drainage....acres..	32,138	.....	3,971	2,960	13,750	8,057	3,400
36	Per cent of increase....	64.6	.....	799.0	[4]	[4]	20.4	[4]
37	Per cent increase is of all improved land in farms, 1920....	0.5	.....	2.1	28.2	9.9	3.1	0.3
38	Timber and cut-over land, 1920....acres..	850	.....	.....	600	250	.....	.....
39	Timber and cut-over land prior to drainage....acres..	1,500	.....	.....	1,000	500	.....	.....
40	Decrease since drainage....acres..	650	.....	.....	400	250	.....	.....
41	Per cent of decrease....	43.3	.....	.....	40.0	50.0	.....	.....
42	Other unimproved land, 1920....acres..	12,188	625	497	640	1,000	8,326	1,100
43	Other unimproved land prior to drainage....acres..	43,676	625	4,468	3,200	14,500	16,383	4,500
44	Decrease since drainage....acres..	31,488	.....	3,971	2,560	13,500	8,057	3,400
45	Per cent of decrease....	72.1	.....	88.9	80.0	93.1	49.2	75.6
46	Swampy, seeped, or alkali land, 1920....acres..	10,873	914	497	640	1,000	7,222	600
47	Swampy, seeped, or alkali land prior to drainage....acres..	38,871	2,803	4,468	3,200	9,000	16,500	2,900
48	Decrease since drainage....acres..	27,998	1,889	3,971	2,560	8,000	9,278	2,300
49	Per cent of decrease....	72.0	67.4	88.9	80.0	88.9	56.2	79.3
	CAPITAL INVESTED AND COST PER ACRE.							
50	Total capital invested in and required for completion of operating enterprises....dollars..	1,436,419	79,200	123,000	47,044	118,500	1,013,675	55,000
51	Capital invested in these enterprises to Dec. 31, 1919....dollars..	1,397,419	50,200	123,000	37,044	118,500	1,013,675	55,000
52	Additional capital required to complete these enterprises....dollars..	39,000	29,000	.....	10,000	.....	.....	.....
53	Average cost per acre when completed....dollars..	15.13	7.66	24.77	11.20	7.90	18.13	12.22
54	Enterprises constructing open ditches only [2]....dollars..	[5] 604,445	46,700	123,000	[5] 47,044	118,500	244,201	25,000
55	Average per acre when completed....dollars..	9.39	5.92	24.77	11.20	7.90	8.44	7.35
56	Enterprises constructing tile drains only [2]....dollars..	192,315	.....	.....	.....	.....	192,315	.....
57	Average cost per acre when completed....dollars..	35.80	.....	.....	.....	.....	35.80	.....
58	Enterprises constructing both open ditches and tile drains [2]....dollars..	639,659	32,500	.....	.....	.....	577,159	30,000
59	Average cost per acre when completed....dollars..	25.44	13.27	.....	.....	.....	26.72	27.27
	CROPS.							
	Improved land in enterprises reporting—							
60	Alfalfa as principal crop on drained land....acres..	52,418	4,825	.....	.....	.....	47,593	.....
61	Hay (except alfalfa,) as principal crop on drained land....acres..	19,710	.....	.....	2,560	13,750	.....	3,400
62	Wheat as principal crop on drained land....acres..	4,468	.....	4,468	.....	.....	.....	.....
63	Not reporting principal crop on drained land....acres..	5,290	4,890	.....	400	.....	.....	.....

[1] Includes only Adams and Spokane Counties.
[2] When works under construction have been completed.
[3] Includes 1,000 acres having open ditches and levees.
[4] More than 1,000 per cent.
[5] Includes cost of 1 mile of levees.

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FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT OF COMMERCE

BULLETIN

BUREAU OF THE CENSUS

DRAINAGE : WISCONSIN

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

INTRODUCTION.

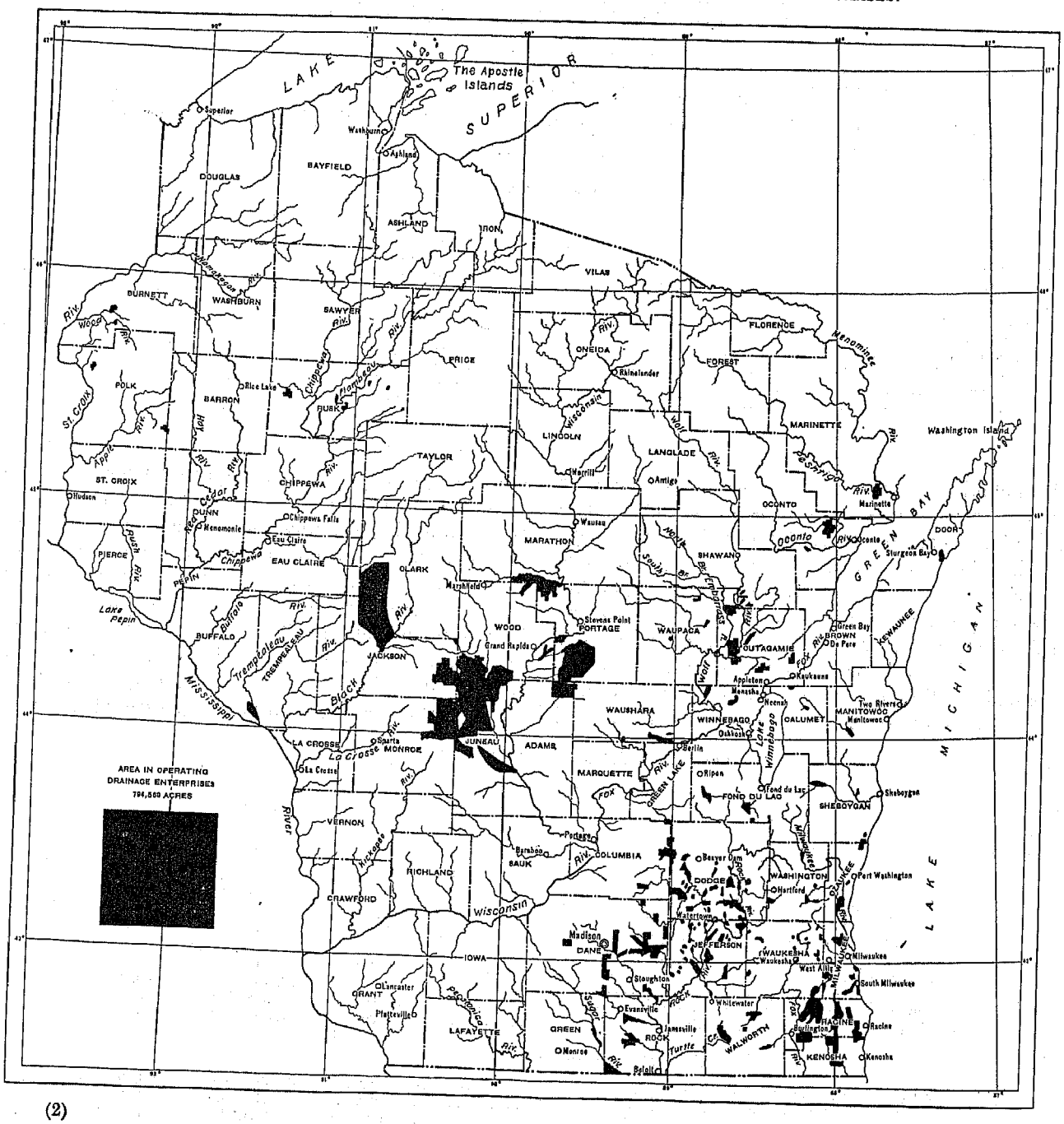
This bulletin presents the statistics of drainage for Wisconsin collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include considerable areas of timbered and other unimproved land not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state	189,295	100.0
Farms reporting land having drainage	21,838	11.5
Farms reporting land needing drainage	52,228	27.6
All land in farms—acres	22,148,223	100.0
Improved land in farms—acres	12,452,216	56.2
Farm land reported as provided with drainage—acres	658,411	3.0
Farm land reported as needing drainage—acres	1,839,273	8.3
DRAINAGE ENTERPRISES.		
Approximate land area of the state—acres	35,363,840	100.0
All land in operating drainage enterprises—acres	794,569	2.2
Improved land—acres	254,504	0.7
Timber and cut-over land—acres	177,744	0.5
Other unimproved land—acres	362,321	1.0
Capital invested in and required for completion of operating enterprises	$4,564,625	100.0
Capital invested in these enterprises to Dec. 31, 1919	$4,163,055	91.2
Additional capital required to complete these enterprises	$401,570	8.8

WISCONSIN.

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (*a*) improved land; (*b*) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (*c*) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by decree of the courts or the town boards of supervisors and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL.[1]		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All organized enterprises	813,569	100.0	$4,168,055	100.0	$512,570
Operating enterprises	794,569	97.7	4,163,055	99.9	401,570
With works completed	572,208	70.3	3,208,944	77.0	.....
With works under construction	222,361	27.3	954,111	22.9	401,570
Nonoperating enterprises	19,000	2.3	5,000	0.1	111,000

[1] The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—More than 60 per cent of the acreage in operating drainage enterprises in Wisconsin is located in a group of seven counties near the center of the state, and most of the other land in such enterprises is in the southeastern counties. There are comparatively few operating enterprises in the northern third of the state and none in the southwestern corner.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All organized enterprises	813,569	100.0	$4,168,055	100.0	$512,570
Operating enterprises	794,569	97.7	4,163,055	99.9	401,570
Illinois River	57,351	7.0	381,130	9.1	.....
Rock River	110,814	13.6	667,670	16.0	43,000
Wisconsin River	370,016	45.5	1,914,833	45.9	37,600
Chippewa River	5,614	0.7	75,414	1.8	13,000
St. Croix River	5,080	0.6	23,678	0.6	.....
Mississippi River	138,037	17.0	219,500	5.3	115,000
Lake Michigan	107,657	13.2	880,830	21.1	192,970
Nonoperating enterprises	19,000	2.3	5,000	0.1	111,000
Rock River	5,000	0.6	1,500	.....	56,000
Wisconsin River	10,500	1.3	.....	.....	30,000
Lake Michigan	3,500	0.4	3,500	0.1	25,000

Condition of land in enterprises.—The drainage enterprises in Wisconsin have been organized in most part for the reclamation of swamp or marsh land or for the improvement of areas that were usually too wet for most profitable cultivation. The tracts generally are near or bordering the smaller streams of the state.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of total.			
All land in enterprises	794,569	100.0	572,208	222,361	19,000
Improved land	254,504	32.0	220,908	33,596	280
Timber and cut-over land	177,744	22.4	84,280	93,464	3,325
Other unimproved land	362,321	45.6	267,020	95,301	15,395
Swampy or subject to overflow	130,111	16.4	68,908	61,203	18,300
Suffering a loss of crops	9,848	1.2	9,774	74	.....

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 290 operating drainage enterprises are counted in Wisconsin, with an average area of 2,740 acres each. There are 29 such enterprises of 5,000 acres or more each, 118 of between 500 and 5,000 acres, and 143 of less than 500 acres each. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises	794,569	794,569	100.0
Less than 200 acres	5,800	5,800	0.7
200 to 499 acres	26,010	26,010	3.3
500 to 999 acres	27,975	27,975	3.5
1,000 to 4,999 acres	168,051	168,051	21.1
5,000 to 9,999 acres	75,427	75,427	9.5
10,000 to 49,999 acres	228,426	228,426	28.7
50,000 to 99,999 acres	262,880	262,880	33.1

Character of enterprises.—All drainage enterprises in Wisconsin, except commercial and private undertakings and districts formed by special acts of the legislature, are either drainage districts operating

under the drainage district law of July 15, 1919 (ch. 557), or "drainages" operating under the farm drainage law of June 27, 1919 (ch. 446). These statutes repealed the earlier laws of the state providing for the formation of drainage enterprises, except so far as might be necessary or expedient to complete undertakings already begun, and all drainage district works and town drains constructed under earlier laws are to be maintained under the new drainage district law and farm drainage law, respectively.

A drainage district is established, according to the law of 1919, by the circuit court of any county in which all or a part of the district is situated, after receipt of a petition from the owners of a major part of the land in the proposed district or from a majority of the owners representing one-third or more of the land. Three drainage commissioners for each district are appointed by the court to investigate as to the feasibility and public utility of the proposed work and, when the district has been established, to administer its affairs. The cost of drainage is assessed against the land in proportion to the benefits that will accrue to the various tracts, but that for any part of the work may be assessed against the particular land or corporation to be benefited by that part. If the cost will exceed the benefits, the enterprise is abandoned, unless one or more petitioners agree to pay the excess and furnish security therefor. The commissioners' preliminary report must include a report from the state chief engineer regarding the practicability and completeness of the proposed plan of improvement and a report from the college of agriculture of the University of Wisconsin regarding the character of the soils and the value of the land for agriculture. If the enterprise will affect any navigable stream, the plan must be approved by the state railroad commission. The plan of drainage improvement and the assessments of damages and of benefits are made by the drainage commissioners. The plan of drainage must be approved or disapproved by the state chief engineer. The court holds public hearings upon the petition for establishment, upon the commissioners' preliminary report, and upon their final report presenting plans, cost estimate, and assessments. The commissioners may issue bonds or notes of the district to finance the work. Subdistricts may be formed within any drainage district, by the circuit court, upon petition and after public hearing; the cost is to be assessed by the commissioners of the original drainage district against the land to be benefited.

Very nearly all the drainage districts in Wisconsin were established under the drainage district law of April 23, 1891 (ch. 401), and the revision of June 17, 1905 (ch. 419). Each of those statutes provided that the districts should be organized by the circuit courts and be administered by three commissioners for each district, and that the cost should be assessed in proportion to the anticipated benefits. The requirements for establishment and the method of organization were much like those of the new drainage district law, but neither of the earlier statutes included any provisions similar to those now requiring that reports upon the proposed work and upon the value of the land be secured from the state chief engineer and the college of agriculture.

A "drainage" under the 1919 statute is established by the county court upon petition from the owners of a major part of the land affected or from a majority of the owners controlling one-third or more of that land, or upon petition from a majority of the town board or boards of supervisors of the town or towns in which the land is situated. All "drainages" are administered by the farm drainage board of the county, composed of three residents appointed by the court when the first petition for a "drainage" is filed. This drainage board makes a preliminary investigation as to the practicability and public utility of the project and, after the "drainage" has been established by decree of the court, prepares the plan of drainage, assesses damages and benefits against the tracts of land, and lets contracts for construction. Public hearings are held by the county court upon the drainage board's preliminary report before the "drainage" is established, and later upon the assessments of damages and of benefits. With its earlier report the drainage board must submit, if the "drainage" will comprise more than 200 acres, a report from the state chief engineer regarding the sufficiency of the proposed work and one from the college of agriculture concerning the character of the soil and the value of the land. The final plan of drainage must be approved by the state chief engineer. The cost of the enterprise may exceed the estimated benefits only if the petitioners give security to cover the excess. The drainage board may issue notes or bonds to finance the work of each "drainage."

Town drains established under laws of March 9, 1871 (ch. 64), and of June 25, 1913 (ch. 579), were in general similar to the "drainages" to be established under the present farm drainage law. Petition for a drain was addressed to the town board of supervisors, which performed approximately the same functions as now are prescribed for the county court and the farm drainage board. For a drain to benefit land within a city or village, petition was addressed to the officials of the city or village, who would appoint a committee to investigate and to construct the drain if the project was approved. The cost was apportioned against the land in proportion to the benefits, and the law of 1871 permitted the landowners to perform the work of construction. No supervision over individual projects was exercised by the state, corresponding to what now is done in requiring reports from the state chief engineer and the college of agriculture.

The first drainage law of this state was enacted in 1852, providing means for one landowner to secure

drainage outlet across the land of an objecting owner, if necessary, through petition to a justice of the peace. A somewhat similar act of 1880 provided for proceedings under the county and circuit courts; an act of 1887 provided for proceedings under the town supervisors. A statute of 1862 (ch. 398) authorized the establishment and construction of county drains by the county board of supervisors upon petition from one or more landowners, damages and benefits being assessed by the supervisors. As amended (Revised Statutes of 1917, sec. 1381) that law authorizes the construction of drains by the county or town boards of supervisors for the benefit of land owned by the counties or towns.

There have been many amendments to the drainage laws that have been mentioned herein, but they have not affected the general form of organization described.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All organized enterprises	813,569	100.0	$4,168,055	100.0	$512,570
Operating enterprises	794,569	97.7	4,163,055	99.9	401,570
Drainage districts	684,888	84.2	3,460,032	83.0	346,820
Laws of 1891, ch. 401	296,183	36.4	1,373,060	32.9	35,600
Laws of 1905, ch. 419	379,705	46.7	2,041,972	49.0	311,220
Special acts	9,000	1.1	45,000	1.1	
"Drainages"	105,681	13.0	664,423	15.9	54,750
Laws of 1871, ch. 64	49,619	6.1	186,664	4.5	750
Laws of 1913, ch. 579	53,140	6.5	449,152	10.8	54,000
Laws of 1919, ch. 446	2,842	0.3	28,607	0.7	
Other[1]	4,080	0.5	38,600	0.9	
Nonoperating enterprises	19,000	2.3	5,000	0.1	111,000
Drainage districts	19,000	2.3	5,000	0.1	111,000
Laws of 1905, ch. 419	15,500	1.9	1,500		86,000
Laws of 1919, ch. 557	3,500	0.4	3,500	0.1	25,000

[1] Includes 1 commercial development, 1 individual ownership, and 1 enterprise not reporting character.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 1,691.3 miles of open ditches, 211.3 miles of tile drains, and 7.7 miles of accessory levees; the additional lengths under construction were 88.0 miles of open ditches, 40.1 miles of tile drains, and 2.5 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one drainage district in Wisconsin, comprising 6,597 acres, drained partly by pumping, having one centrifugal pump operated by steam engines of 150 horsepower.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

County Table II, line 16, shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises, as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted, because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include both of these groups, computed as 3 feet and 10 feet, respectively, would make the mean depth for the state 7.0 instead of 6.5 feet.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		Additional required to complete.
	Acreage.	Per cent of total.	Amount.	Per cent of total.	
All kinds	794,569	100.0	$4,163,055	100.0	$401,570
Open ditches only	657,668	82.8	2,942,667	70.7	279,350
Open ditches and levees	27,584	3.5	282,666	6.8	
Tile drains only	2,958	0.4	59,770	1.4	
Open ditches and tile drains	102,359	12.9	834,952	20.1	72,220
Open ditches, tile drains and levees	4,000	0.5	43,000	1.0	50,000

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises	794,569	100.0
Less than 3 feet	520	0.1
3.0 to 3.9 feet	17,669	2.2
4.0 to 4.9 feet	72,916	9.2
5.0 to 5.9 feet	25,622	3.2
6.0 to 6.9 feet	186,683	23.5
7.0 to 7.9 feet	79,349	10.0
8.0 to 8.9 feet	217,735	27.4
9.0 to 9.9 feet	18,000	2.3
10.0 feet and more	83,800	10.5
Not reporting branches	92,275	11.6

Maintenance of works.—The drainage district law of 1919 requires that the commissioners of each drainage district file with the circuit court each year a report including a statement of what repairs will be necessary during the coming year and an assessment to cover the necessary repairs, maintenance, and incidental expenses. The court hears all objections and determines the amounts of assessment. The laws of 1891 and 1905 also authorized the levy of assessments for maintenance of the drains.

The farm drainage law requires the farm drainage board of each county to report annually to the county court regarding each "drainage" under its control, including a statement of the repairs needed in the ensuing year and an assessment to cover the cost of

maintenance apportioned according to the confirmed benefits. The court hears objections to the report before confirming the assessment. The town drain law of 1913 authorized the town supervisors to levy assessments for repair purposes, and that of 1871 required each landowner affected to keep in repair the section of drain assigned to him by the town supervisors.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All operating enterprises	794,569	100.0	$4,163,055	100.0	$401,570
By district forces	181,416	22.8	1,038,827	25.0	2,750
By contract	349,886	44.0	2,109,393	50.7	39,600
By landowners	29,255	3.7	68,523	1.6	.....
By method not specified	14,866	1.9	152,947	3.7	.....
No maintenance provided	212,215	26.7	744,585	17.9	330,220
Not reporting	6,931	0.9	48,780	1.2	20,000

Date of organization.—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts or the town boards of supervisors, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and since the work of construction might occupy some years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises	794,569	100.0	794,569	100.0
1870 to 1879	695	0.1	695	0.1
1880 to 1889	16,158	2.0	16,158	2.0
1890 to 1899	5,173	0.7	5,173	0.7
1900 to 1904	294,978	37.1	294,978	37.1
1905 to 1909	145,692	18.3	145,692	18.3
1910 to 1914	111,102	14.0	111,102	14.0
1915 to 1919	218,424	27.5	218,424	27.5
Not reported	2,347	0.3	2,347	0.3

Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL INVESTED.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises	$4,163,055	100.0	$401,570
1870 to 1879	2,800	0.1	.....
1880 to 1889	65,966	1.6	.....
1890 to 1899	9,063	0.2	.....
1900 to 1904	1,314,577	31.6	36,350
1905 to 1909	1,042,098	25.0	.....
1910 to 1914	744,494	17.9	.....
1915 to 1919	963,693	23.1	365,220
Not reported	20,364	0.5	.....

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees	1,779.3	100.0	251.4	100.0	10.2	100.0
1870 to 1879	9.5	0.5	.....	.....	.....	.....
1880 to 1889	59.7	3.4	.....	.....	.....	.....
1890 to 1899	26.3	1.5	.....	.....	.....	.....
1900 to 1904	551.6	31.0	.....	.....	.....	.....
1905 to 1909	455.6	25.6	19.5	7.8	2.6	25.5
1910 to 1914	311.3	17.5	19.0	7.6	5.1	50.0
1915 to 1919	357.0	20.1	211.6	84.2	2.5	24.5
Not reported	8.3	0.5	1.3	0.5	.....	.....

Crops.—The principal crops grown upon the drained land in drainage enterprises are hay and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II: No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adams.	Ashland.	Barron.	Bayfield.	Brown.	Buffalo.	Burnett.	Calumet.
1	Number of all farms in the state or county	189,295	1,557	1,131	4,516	1,791	3,498	2,089	1,872	2,087
2	Farms reporting land having drainage	21,838	87	32	117	252	517	51	145	255
3	Farms reporting land needing drainage	52,228	259	447	1,028	323	1,200	313	695	336
4	Farms in drainage and levee districts	3,693	34	2	22	.....	19	3	29	20
	LAND AND FARM AREA.									
5	Approximate land area of the state or county—acres	35,363,840	437,760	692,480	566,400	961,920	338,560	439,680	550,400	207,360
6	All land in farms—acres	22,148,223	304,575	108,270	449,565	172,496	304,745	418,261	236,886	194,623
7	Improved land in farms—acres	12,452,216	148,138	36,253	208,936	50,389	207,027	202,321	79,611	145,005
8	Woodland in farms—acres	5,401,910	111,264	56,659	121,719	82,071	47,859	151,650	117,520	19,979
9	Other unimproved land in farms—acres	4,294,097	45,173	15,358	118,910	40,036	49,859	64,290	39,755	20,639
10	Farm land reported as provided with drainage—acres	658,411	7,827	665	2,477	5,460	12,761	1,069	4,035	5,660
11	Farm land reported as needing drainage—acres	1,839,273	13,245	27,845	41,158	15,835	30,578	8,019	33,012	7,084
12	Drainage only—acres	461,612	5,325	879	3,733	658	6,012	2,154	6,217	3,963
13	Drainage and clearing—acres	1,377,661	7,920	26,966	37,425	15,177	24,566	5,865	26,795	3,121

		Chippewa.	Clark.	Columbia.	Dane.	Dodge.	Door.	Douglas.	Dunn.	Eau Claire.	Fond du Lac.
1	Number of all farms in the county	3,729	5,116	3,320	6,217	4,633	2,396	1,557	3,566	2,368	4,190
2	Farms reporting land having drainage	123	188	436	721	1,051	181	55	123	91	536
3	Farms reporting land needing drainage	1,459	1,530	906	1,604	1,193	626	1,001	729	511	1,005
4	Farms in drainage and levee districts	22	32	231	177	187	11	3	36	17	77
	LAND AND FARM AREA.										
5	Approximate land area of the county—acres	664,960	779,520	497,920	769,280	574,080	300,160	855,680	556,160	408,320	464,640
6	All land in farms—acres	457,998	476,377	463,639	721,156	522,217	264,126	154,671	490,044	307,346	446,710
7	Improved land in farms—acres	227,691	195,802	301,889	512,269	374,939	149,557	40,428	265,693	194,467	321,182
8	Woodland in farms—acres	130,048	137,131	66,362	85,501	36,202	79,959	69,791	150,405	68,504	32,672
9	Other unimproved land in farms—acres	100,259	143,444	95,388	123,386	111,076	34,610	44,452	73,946	44,375	92,856
10	Farm land reported as provided with drainage—acres	2,349	4,864	11,344	16,859	22,152	2,986	1,012	2,685	1,846	14,792
11	Farm land reported as needing drainage—acres	70,001	72,922	32,867	34,919	30,395	17,112	63,343	26,392	17,603	20,393
12	Drainage only—acres	6,411	5,128	18,285	24,215	21,689	3,596	1,089	3,432	2,030	12,744
13	Drainage and clearing—acres	63,590	67,794	14,582	10,704	8,706	13,516	62,254	22,960	15,573	7,649

		Forest.	Green.	Green Lake.	Iowa.	Jackson.	Jefferson.	Juneau.	Kenosha.	Kewaunee.	Lafayette.
1	Number of all farms in the county	535	2,330	1,507	2,527	2,577	3,263	2,479	1,383	2,065	2,360
2	Farms reporting land having drainage	6	219	131	67	87	1,022	537	861	455	107
3	Farms reporting land needing drainage	167	388	346	140	746	1,186	915	797	1,007	260
4	Farms in drainage and levee districts	.....	14	39	2	32	187	291	99	11	1
	LAND AND FARM AREA.										
5	Approximate land area of the county—acres	650,880	379,520	230,400	499,840	633,600	353,280	513,280	180,480	215,680	410,880
6	All land in farms—acres	56,029	344,542	213,518	460,938	389,345	331,204	327,561	155,832	210,584	373,121
7	Improved land in farms—acres	16,950	270,680	141,371	254,424	190,401	218,129	171,114	112,255	146,626	272,481
8	Woodland in farms—acres	24,695	35,290	21,469	85,004	128,098	43,622	95,359	15,471	33,937	35,308
9	Other unimproved land in farms—acres	14,384	38,572	50,678	121,510	70,846	69,453	61,088	28,106	30,021	65,332
10	Farm land reported as provided with drainage—acres	637	6,835	4,422	1,069	4,621	23,459	35,627	39,804	14,083	2,803
11	Farm land reported as needing drainage—acres	10,703	9,210	10,804	3,400	37,328	31,875	39,698	24,636	21,768	5,843
12	Drainage only—acres	562	5,328	5,187	1,910	7,138	18,740	11,528	15,949	6,057	3,045
13	Drainage and clearing—acres	10,141	3,882	5,617	1,490	30,190	13,135	28,170	8,687	15,711	2,798

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Manitowoc.	Marathon.	Marinette.	Marquette.	Milwaukee.	Monroe.	Oconto.	Outagamie.	Ozaukee.	Pepin.
1	Number of all farms in the county	3,904	6,058	2,531	1,432	2,574	3,519	3,114	3,746	1,727	1,034
2	Farms reporting land having drainage	1,464	66	181	222	1,167	181	242	761	617	35
3	Farms reporting land needing drainage	1,630	1,961	1,506	420	760	533	1,325	1,307	874	75
4	Farms in drainage and levee districts	109	6	112	18	184	131	40	45	90	4
	LAND AND FARM AREA.										
5	Approximate land area of the county—acres	385,280	994,560	905,600	292,480	150,400	599,680	715,520	413,440	149,120	151,040
6	All land in farms—acres	358,511	650,959	275,738	271,317	111,033	468,553	310,037	347,824	141,115	140,263
7	Improved land in farms—acres	251,176	242,357	107,444	133,773	90,258	231,049	151,639	236,561	107,739	75,698
8	Woodland in farms—acres	54,581	243,986	79,096	85,306	12,921	155,752	90,551	44,915	12,092	48,316
9	Other unimproved land in farms—acres	52,754	164,616	89,198	52,238	7,854	81,752	61,847	66,348	21,284	16,254
10	Farm land reported as provided with drainage—acres	34,705	1,688	5,735	8,287	22,542	8,494	9,531	26,772	13,477	1,077
11	Farm land reported as needing drainage—acres	20,564	93,246	84,384	17,969	12,176	18,765	53,135	47,510	14,718	2,030
12	Drainage only—acres	14,690	5,249	5,563	8,169	5,592	7,887	8,213	17,319	6,795	106
13	Drainage and clearing—acres	14,874	87,997	78,821	9,800	6,584	10,878	44,922	30,191	7,923	1,924

		Polk.	Portage.	Price.	Racine.	Richland.	Rock.	Rusk.	Sauk.	Shawano.	Sheboygan.
1	Number of all farms in the county	4,053	3,326	1,935	2,215	2,533	3,660	1,946	3,697	3,977	3,664
2	Farms reporting land having drainage	103	312	46	1,619	116	335	44	200	303	1,262
3	Farms reporting land needing drainage	1,196	534	1,272	1,170	305	702	794	578	1,393	1,630
4	Farms in drainage and levee districts	56	251	3	473	6	64	55	4	13	30
	LAND AND FARM AREA.										
5	Approximate land area of the county—acres	598,400	519,680	818,560	207,360	377,600	458,240	592,000	538,880	741,120	333,440
6	All land in farms—acres	434,216	427,913	161,894	195,963	361,450	427,083	184,213	494,925	431,614	311,332
7	Improved land in farms—acres	185,140	250,287	40,387	146,456	186,824	343,328	46,676	279,878	193,770	226,734
8	Woodland in farms—acres	186,044	103,858	71,921	20,969	132,623	38,825	24,518	135,662	140,511	42,561
9	Other unimproved land in farms—acres	63,032	73,768	49,586	28,538	42,003	44,930	113,019	79,385	97,333	42,037
10	Farm land reported as provided with drainage—acres	2,157	31,913	598	71,843	1,644	11,876	596	4,521	6,456	34,208
11	Farm land reported as needing drainage—acres	46,595	26,059	66,150	30,557	6,405	22,206	27,886	12,603	44,823	27,400
12	Drainage only—acres	5,069	3,244	1,430	18,781	2,887	12,727	2,281	6,822	11,283	13,395
13	Drainage and clearing—acres	40,626	22,815	64,720	11,776	3,518	9,479	25,605	5,781	33,540	14,005

		Trempealeau.	Walworth.	Washburn.	Washington.	Waukesha.	Waupaca.	Waushara.	Winnebago.	Wood.	Other counties.[1]
1	Number of all farms in the county	3,138	2,779	1,380	2,799	3,406	3,770	2,468	2,711	3,066	26,469
2	Farms reporting land having drainage	98	560	23	623	1,075	345	190	709	350	137
3	Farms reporting land needing drainage	576	972	422	1,129	306	1,142	372	1,023	893	4,271
4	Farms in drainage and levee districts	10	59	.....	87	.....	62	18	44	108	13
	LAND AND FARM AREA.										
5	Approximate land area of the county—acres	478,720	358,400	534,400	275,840	351,360	485,760	413,440	293,760	517,760	7,578,880
6	All land in farms—acres	461,525	330,011	178,298	264,351	333,519	420,206	303,417	256,327	321,907	3,350,325
7	Improved land in farms—acres	270,239	239,308	57,827	174,486	227,310	236,807	233,745	186,332	137,063	1,705,897
8	Woodland in farms—acres	135,567	38,037	71,401	38,230	52,073	92,965	84,493	25,511	79,030	970,046
9	Other unimproved land in farms—acres	55,719	52,666	49,070	51,635	54,136	90,434	45,179	44,484	105,814	680,382
10	Farm land reported as provided with drainage—acres	1,293	16,020	633	9,339	18,202	7,473	6,595	21,468	22,876	2,189
11	Farm land reported as needing drainage—acres	14,044	26,322	27,953	20,584	5,659	32,364	11,908	24,778	44,836	188,056
12	Drainage only—acres	6,331	18,959	4,100	13,144	2,863	12,993	4,636	14,639	8,358	14,183
13	Drainage and clearing—acres	8,313	7,363	23,853	7,440	2,796	19,371	7,272	10,139	36,478	173,873

[1] No drainage reported in Crawford, Florence, Grant, Iron, La Crosse, Langlade, Lincoln, Oneida, Pierce, St. Croix, Sawyer, Taylor, Vernon, and Vilas Counties.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Adams.	Clark.	Columbia.	Dane.	Dodge.	Door.	Fond du Lac.
	LAND AREA.								
1	Approximate land area of the state or county ..... acres..	35,363,840	437,760	779,520	497,920	769,280	574,080	300,160	464,640
2	All land in operating drainage enterprises ..... acres..	794,569	16,390	98,000	4,668	39,239	21,597	4,000	5,935
3	Improved land ..... acres..	254,504	9,834	9,800	2,204	6,535	4,482	600	1,778
4	Per cent of all improved land in farms	2.0	6.6	5.0	0.7	1.3	1.2	0.4	0.6
5	Timber and cut-over land ..... acres..	177,744	4,098	68,600	.....	.....	108	800	389
6	Other unimproved land ..... acres..	362,321	2,458	19,600	2,464	32,704	17,007	2,600	3,768
7	Swampy or subject to overflow, in enterprises ..... acres..	130,111	2,458	49,000	935	6,896	3,291	1,000	925
8	Suffering loss of crops from defective drainage ..... acres..	9,848	983	.....	28	30	200	.....	25
9	Assessed acreage	794,569	16,390	98,000	4,668	39,239	21,597	4,000	5,935
10	Excess over all land in enterprises ..... acres..	.....	.....	.....	.....	.....	.....	.....	.....
	DRAINAGE WORKS.								
	Open ditches:								
11	Completed ..... miles..	1,691.3	50.3	23.3	24.2	114.0	103.0	1.1	28.6
12	Additional under construction ..... miles..	88.0	.....	46.7	.....	5.8	.....	0.9	.....
13	Maximum completed in any enterprise ..... miles..	144.5	50.3	23.3	7.0	26.0	10.5	1.1	4.0
14	Maximum width at bottom of ditch [1] ..... feet..	60	16	10	8	24	8	3	40
15	Maximum of average depths of outlet ditches [1] ..... feet..	13.0	8.0	6.0	10.0	10.0	10.0	4.0	7.0
16	Mean depth of branch ditches [1] ..... feet..	6.5	8.0	6.0	5.1	5.0	3.7	.....	7.0
	Tile drains:								
17	Completed ..... miles..	211.3	.....	.....	.....	97.0	3.7	.....	0.3
18	Additional under construction ..... miles..	40.1	.....	.....	.....	7.3	.....	5.5	.....
19	Maximum completed in any enterprise ..... miles..	43.0	.....	.....	.....	43.0	1.2	.....	0.3
20	Maximum size of tile [1] ..... inches..	30	.....	.....	.....	24	24	.....	12
	Accessory levees and dikes:								
21	Completed ..... miles..	7.7	.....	.....	.....	.....	.....	.....	.....
22	Additional under construction ..... miles..	2.5	.....	.....	.....	.....	.....	.....	.....
	Pumping plants:								
23	Engine capacity ..... horsepower..	150	.....	.....	.....	.....	.....	.....	.....
24	Pump capacity ..... gallons per minute..	.....	.....	.....	.....	.....	.....	.....	.....
25	Area served by pumps ..... acres..	6,597	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only [1] ..... acres..	657,668	16,390	98,000	4,668	25,398	19,259	.....	5,485
27	Length of these ditches ..... miles..	1,402.6	50.3	70.0	24.2	88.2	93.0	.....	26.3
28	Average length per acre ..... feet..	11.7	16.2	3.8	27.4	18.3	25.5	.....	25.3
29	Area having open ditches and levees [1] ..... acres..	27,584	.....	.....	.....	.....	.....	.....	.....
30	Length of these ditches ..... miles..	79.1	.....	.....	.....	.....	.....	.....	.....
31	Average length per acre ..... feet..	15.1	.....	.....	.....	.....	.....	.....	.....
32	Length of the accessory levees ..... miles..	7.7	.....	.....	.....	.....	.....	.....	.....
33	Area drained by tile only [1] ..... acres..	2,958	.....	.....	.....	1,270	60	.....	.....
34	Length of these tile ..... miles..	97.2	.....	.....	.....	83.0	1.0	.....	.....
35	Average length per acre ..... feet..	173.5	.....	.....	.....	345.1	88.0	.....	.....
36	Area drained by open ditches and tile [1] ..... acres..	102,359	.....	.....	.....	12,571	2,278	4,000	450
37	Length of these drains ..... miles..	347.6	.....	.....	.....	52.9	12.7	7.5	2.6
38	Average length per acre ..... feet..	17.9	.....	.....	.....	22.2	29.4	9.9	30.5
39	Area having open ditches, tile drains, and levees [1] ..... acres..	4,000	.....	.....	.....	.....	.....	.....	.....
40	Length of these drains ..... miles..	44.2	.....	.....	.....	.....	.....	.....	.....
41	Average length per acre ..... feet..	58.3	.....	.....	.....	.....	.....	.....	.....
42	Length of the accessory levees ..... miles..	2.5	.....	.....	.....	.....	.....	.....	.....
	DEVELOPMENT OF LAND.								
43	Improved land in operating enterprises, 1920 ..... acres..	254,504	9,834	9,800	2,204	6,535	4,482	600	1,778
44	Improved land prior to drainage ..... acres..	50,071	.....	9,800	.....	1,333	398	.....	761
45	Increase since drainage ..... acres..	204,433	9,834	.....	2,204	5,202	4,084	600	1,017
46	Per cent of increase	408.3	.....	.....	.....	390.2	.....	.....	133.6
47	Per cent increase is of all improved land in farms, 1920	1.6	6.6	.....	0.7	1.0	1.1	0.4	0.3
48	Timber and cut-over land, 1920 ..... acres..	177,744	4,098	68,600	.....	.....	108	800	389
49	Timber and cut-over land prior to drainage ..... acres..	231,732	12,292	68,600	.....	1,220	144	800	389
50	Decrease since drainage ..... acres..	53,988	8,194	.....	.....	1,220	36	.....	.....
51	Per cent of decrease	23.3	66.7	.....	.....	100.0	25.0	.....	.....
52	Other unimproved land, 1920 ..... acres..	362,321	2,458	19,600	2,464	32,704	17,007	2,600	3,768
53	Other unimproved land prior to drainage ..... acres..	512,766	4,098	19,600	4,668	36,686	21,055	3,200	4,785
54	Decrease since drainage ..... acres..	150,445	1,640	.....	2,204	3,982	4,048	600	1,017
55	Per cent of decrease	29.3	40.0	.....	47.2	10.9	19.2	18.8	21.3
56	Swampy or subject to overflow, 1920 ..... acres..	130,111	2,458	49,000	935	6,896	3,291	1,000	925
57	Swampy or subject to overflow prior to drainage ..... acres..	701,307	16,390	68,600	4,668	37,779	21,357	2,400	5,333
58	Decrease since drainage ..... acres..	571,196	13,932	19,600	3,683	30,883	18,066	1,400	4,408
59	Per cent of decrease	81.4	85.0	28.6	78.9	81.7	84.6	58.3	82.7
	CAPITAL INVESTED AND COST PER ACRE.								
60	Total capital invested in and required for completion of operating enterprises ..... dollars..	4,564,625	98,000	159,000	41,352	346,313	95,545	28,000	72,066
61	Capital invested in these enterprises to Dec. 31, 1919 ..... dollars..	4,163,055	98,000	44,000	41,352	326,313	95,545	3,000	72,066
62	Additional capital required to complete these enterprises ..... dollars..	401,570	.....	115,000	.....	20,000	.....	25,000	.....
63	Average cost per acre when completed ..... dollars..	5.74	5.98	1.62	8.86	8.83	4.42	7.00	12.14
64	Enterprises constructing open ditches only ..... dollars..	3,222,017	98,000	159,000	41,352	190,607	52,755	.....	65,509
65	Average cost per acre when completed ..... dollars..	4.90	5.98	1.62	8.86	7.50	2.74	.....	11.94
66	Enterprises constructing open ditches and levees ..... dollars..	282,666	.....	.....	.....	.....	.....	.....	.....
67	Average cost per acre when completed ..... dollars..	10.25	.....	.....	.....	.....	.....	.....	.....
68	Enterprises constructing tile drains only ..... dollars..	59,770	.....	.....	.....	33,000	1,000	.....	.....
69	Average cost per acre when completed ..... dollars..	20.21	.....	.....	.....	25.98	16.67	.....	.....
70	Enterprises constructing open ditches and tile drains ..... dollars..	907,172	.....	.....	.....	122,706	41,790	28,000	6,557
71	Average cost per acre when completed ..... dollars..	8.86	.....	.....	.....	9.76	18.35	7.00	14.57
72	Enterprises constructing open ditches, tile drains, and levees ..... dollars..	93,000	.....	.....	.....	.....	.....	.....	.....
73	Average cost per acre when completed ..... dollars..	23.25	.....	.....	.....	.....	.....	.....	.....
	CROPS.								
74	Improved land in enterprises reporting—								
75	Hay as principal crop on drained land ..... acres..	97,966	9,834	.....	1,606	2,744	680	600	306
76	Corn as principal crop on drained land ..... acres..	97,075	.....	.....	38	2,121	3,802	.....	932
77	Small grains as principal crop on drained land ..... acres..	24,066	.....	.....	560	200	.....	.....	.....
78	Vegetables as principal crop on drained land ..... acres..	2,647	.....	.....	.....	1,470	.....	.....	.....
79	Other crops as principal ones on drained land ..... acres..	19,590	.....	.....	.....	.....	.....	.....	.....
80	Not reporting principal crop on drained land ..... acres..	32,760	.....	29,400	.....	.....	.....	.....	540

[1] When works under construction have been completed.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Jackson.	Jefferson.	Juneau.	Kenosha.	Marathon.	Milwaukee.	Monroe.	Oconto.
LAND AREA.								
1 Approximate land area of the county ..... acres	633,600	353,280	513,280	180,480	994,560	150,400	599,680	715,520
2 All land in operating drainage enterprises ..... acres	46,760	17,461	133,297	11,803	11,679	8,392	61,100	4,300
3 Improved land ..... acres	4,140	5,630	27,904	10,277	2,336	7,355	27,641	2,000
4 Per cent of all improved land in farms	2.2	2.6	16.3	9.2	1.0	8.1	12.0	1.3
5 Timber and cut-over land ..... acres	15,264	18	38,069	.....	8,175	.....	21,472	490
6 Other unimproved land ..... acres	27,356	11,813	67,324	1,526	1,168	1,037	11,987	1,810
7 Swampy or subject to overflow, in enterprises ..... acres	.....	1,436	7,014	1,004	.....	.....	29,158	770
8 Suffering loss of crops from defective drainage ..... acres	.....	204	445	.....	.....	.....	1,162	.....
9 Assessed acreage	46,760	17,461	133,297	11,803	11,679	8,392	61,100	4,300
10 Excess over all land in enterprises ..... acres	.....	.....	.....	.....	.....	.....	.....	.....
DRAINAGE WORKS.								
Open ditches:								
11 Completed ..... miles	25.2	93.4	289.3	14.5	19.0	49.2	80.3	12.3
12 Additional under construction ..... miles	4.8	.....	9.2	.....	.....	.....	0.8	4.9
13 Maximum completed in any enterprise ..... miles	13.0	5.6	144.5	7.0	19.0	8.5	50.8	11.3
14 Maximum width at bottom of ditch [1] ..... feet	30	8	40	30	60	18	20	10
15 Maximum of average depths of outlet ditches ..... feet	10.0	7.0	10.0	9.0	8.0	9.0	10.0	6.5
16 Mean depth of branch ditches [1] ..... feet	7.0	3.2	6.1	7.0	7.0	.....	7.4	5.7
Tile drains:								
17 Completed ..... miles	.....	8.2	.....	10.0	.....	4.8	.....	.....
18 Additional under construction ..... miles	.....	.....	.....	0.7	.....	.....	.....	1.0
19 Maximum completed in any enterprise ..... miles	.....	3.5	.....	4.2	.....	2.3	.....	.....
20 Maximum size of tile [1] ..... inches	.....	18	.....	30	.....	20	.....	.....
Accessory levees and dikes:								
21 Completed ..... miles	.....	.....	0.8	.....	.....	.....	.....	.....
22 Additional under construction ..... miles	.....	.....	.....	.....	.....	.....	.....	.....
Pumping plants:								
23 Engine capacity ..... horsepower	.....	.....	.....	.....	.....	.....	.....	.....
24 Pump capacity ..... gallons per minute	.....	.....	.....	.....	.....	.....	.....	.....
25 Area served by pumps ..... acres	.....	.....	.....	.....	.....	.....	.....	.....
26 Area drained by open ditches only [1] ..... acres	46,760	16,337	128,357	40	11,679	7,332	61,100	600
27 Length of these ditches ..... miles	30.0	88.4	282.5	0.5	19.0	47.2	81.1	1.0
28 Average length per acre ..... feet	3.4	28.6	11.6	66.0	8.6	34.0	7.0	8.8
29 Area having open ditches and levees [1] ..... acres	.....	.....	4,940	.....	.....	.....	.....	.....
30 Length of these ditches ..... miles	.....	.....	16.0	.....	.....	.....	.....	.....
31 Average length per acre ..... feet	.....	.....	17.1	.....	.....	.....	.....	.....
32 Length of the accessory levees ..... miles	.....	.....	0.8	.....	.....	.....	.....	.....
33 Area drained by tile only [1] ..... acres	.....	230	.....	.....	.....	820	.....	.....
34 Length of these tile ..... miles	.....	2.9	.....	.....	.....	3.8	.....	.....
35 Average length per acre ..... feet	.....	66.6	.....	.....	.....	24.5	.....	.....
36 Area drained by open ditches and tile [1] ..... acres	.....	894	.....	11,763	.....	240	.....	3,700
37 Length of these drains ..... miles	.....	10.3	.....	24.7	.....	3.0	.....	17.2
38 Average length per acre ..... feet	.....	60.8	.....	11.1	.....	66.0	.....	24.5
39 Area having open ditches, tile drains, and levees [1] ..... acres	.....	.....	.....	.....	.....	.....	.....	.....
40 Length of these drains ..... miles	.....	.....	.....	.....	.....	.....	.....	.....
41 Average length per acre ..... feet	.....	.....	.....	.....	.....	.....	.....	.....
42 Length of the accessory levees ..... miles	.....	.....	.....	.....	.....	.....	.....	.....
DEVELOPMENT OF LAND.								
43 Improved land in operating enterprises, 1920 ..... acres	4,140	5,630	27,904	10,277	2,336	7,355	27,641	2,000
44 Improved land prior to drainage ..... acres	2,500	50	3,271	4	.....	.....	3,384	1,480
45 Increase since drainage ..... acres	1,640	5,580	24,633	10,273	2,336	7,355	24,257	520
46 Per cent of increase [2]	65.6	.....	753.1	.....	.....	.....	716.8	35.1
47 Per cent increase is of all improved land in farms, 1920	0.9	2.6	14.4	9.2	1.0	8.1	10.5	0.3
48 Timber and cut-over land, 1920 ..... acres	15,264	18	38,069	.....	8,175	.....	21,472	490
49 Timber and cut-over land prior to drainage ..... acres	15,264	18	41,309	280	10,511	.....	45,344	490
50 Decrease since drainage ..... acres	.....	.....	3,240	280	2,336	.....	23,872	.....
51 Per cent of decrease	.....	.....	7.8	100.0	22.2	.....	52.6	.....
52 Other unimproved land, 1920 ..... acres	27,356	11,813	67,324	1,526	1,168	1,037	11,987	1,810
53 Other unimproved land prior to drainage ..... acres	28,996	17,393	88,717	11,519	1,168	8,392	12,372	2,330
54 Decrease since drainage ..... acres	1,640	5,580	21,393	9,993	.....	7,355	385	520
55 Per cent of decrease	5.7	32.1	24.1	86.8	.....	87.6	3.1	22.3
56 Swampy or subject to overflow, 1920 ..... acres	.....	1,436	7,014	1,004	.....	.....	29,158	770
57 Swampy or subject to overflow prior to drainage ..... acres	28,996	17,461	126,540	11,519	11,679	8,392	57,100	2,420
58 Decrease since drainage ..... acres	28,996	16,025	119,526	10,515	11,679	8,392	27,942	1,650
59 Per cent of decrease	100.0	91.8	94.5	91.3	100.0	100.0	48.9	68.2
CAPITAL INVESTED AND COST PER ACRE.								
60 Total capital invested in and required for completion of operating enterprises ..... dollars	113,570	47,187	761,004	100,100	53,200	110,120	167,039	44,232
61 Capital invested in these enterprises to Dec. 31, 1919 ..... dollars	101,800	47,187	739,100	100,100	53,200	110,120	165,113	30,012
62 Additional capital required to complete these enterprises ..... dollars	11,770	.....	21,904	.....	.....	.....	1,926	14,220
63 Average cost per acre when completed ..... dollars	2.43	2.70	5.71	8.48	4.56	13.12	2.73	10.20
64 Enterprises constructing open ditches only ..... dollars	113,570	20,334	711,504	400	53,200	95,141	167,039	312
65 Average cost per acre when completed ..... dollars	2.43	1.80	5.54	10.00	4.56	12.98	2.73	0.52
66 Enterprises constructing open ditches and levees ..... dollars	.....	.....	49,500	.....	.....	.....	.....	.....
67 Average cost per acre when completed ..... dollars	.....	.....	10.02	.....	.....	.....	.....	.....
68 Enterprises constructing tile drains only ..... dollars	.....	4,763	.....	.....	.....	6,479	.....	.....
69 Average cost per acre when completed ..... dollars	.....	20.67	.....	.....	.....	7.90	.....	.....
70 Enterprises constructing open ditches and tile drains ..... dollars	.....	13,100	.....	99,700	.....	8,500	.....	43,920
71 Average cost per acre when completed ..... dollars	.....	14.65	.....	8.48	.....	35.42	.....	11.87
72 Enterprises constructing open ditches, tile drains, and levees ..... dollars	.....	.....	.....	.....	.....	.....	.....	.....
73 Average cost per acre when completed ..... dollars	.....	.....	.....	.....	.....	.....	.....	.....
CROPS.								
74 Improved land in enterprises reporting—								
75 Hay as principal crop on drained land ..... acres	1,640	181	8,905	.....	2,336	.....	23,622	150
76 Corn as principal crop on drained land ..... acres	.....	5,129	1,500	10,249	.....	6,345	4,000	.....
77 Small grains as principal crop on drained land ..... acres	.....	.....	15,050	.....	.....	.....	.....	.....
78 Vegetables as principal crop on drained land ..... acres	.....	.....	.....	28	.....	910	.....	.....
79 Other crops as principal ones on drained land ..... acres	.....	.....	2,449	.....	.....	100	19	1,850
80 Not reporting principal crop on drained land ..... acres	2,500	320	.....	.....	.....	.....	.....	.....

[1] When works under construction have been completed.

[2] Per cent not shown when more than 1,000.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Outagamie.	Ozaukee.	Portage.	Racine.	Rock.	Rusk.	Shawano.	Sheboygan.
	LAND AREA.								
1	Approximate land area of the county ..... acres..	413,440	149,120	519,680	207,360	458,240	592,000	741,120	333,440
2	All land in operating drainage enterprises ..... acres..	18,305	5,960	67,567	61,847	15,792	5,174	4,600	7,106
3	Improved land ..... acres..	5,468	4,462	21,734	47,265	5,372	1,104	2,970	561
4	Per cent of all improved land in farms	2.3	4.1	8.7	32.3	1.6	2.4	1.5	0.2
5	Timber and cut-over land ..... acres..	649	928	.....	2,920	.....	174	.....	3,206
6	Other unimproved land ..... acres..	12,188	570	45,833	11,662	10,420	3,896	1,630	3,339
7	Swampy or subject to overflow, in enterprises ..... acres..	530	.....	5,500	5,562	4,656	712	720	4,000
8	Suffering loss of crops from defective drainage ..... acres..	.....	.....	5,500	414	72	.....	.....	.....
9	Assessed acreage	18,305	5,960	67,567	61,847	15,792	5,174	4,600	7,106
10	Excess over all land in enterprises ..... acres..	.....	.....	.....	.....	.....	.....	.....	.....
	DRAINAGE WORKS.								
	Open ditches:								
11	Completed ..... miles..	68.4	23.7	153.4	95.3	30.5	17.6	16.0	23.4
12	Additional under construction ..... miles..	6.6	1.0	.....	.....	.....	.....	1.1	6.2
13	Maximum completed in any enterprise ..... miles..	23.4	4.9	108.0	37.5	9.0	5.8	5.0	18.8
14	Maximum width at bottom of ditch [1] ..... feet..	6	25	60	30	20	2	6	36
15	Maximum of average depths of outlet ditches [1] ..... feet..	8.0	8.0	8.0	12.0	8.0	9.0	8.0	13.0
16	Mean depth of branch ditches [1] ..... feet..	4.3	6.6	7.8	7.0	5.9	3.0	.....	7.0
	Tile drains:								
17	Completed ..... miles..	.....	2.1	.....	31.7	.....	36.1	.....	4.4
18	Additional under construction ..... miles..	14.2	.....	.....	0.4	.....	11.0	.....	.....
19	Maximum completed in any enterprise ..... miles..	.....	1.1	.....	10.3	.....	26.7	.....	2.0
20	Maximum size of tile [1] ..... inches..	16	15	.....	24	.....	16	.....	15
	Accessory levees and dikes:								
21	Completed ..... miles..	1.0	.....	.....	.....	.....	.....	.....	.....
22	Additional under construction ..... miles..	2.5	.....	.....	.....	.....	.....	.....	.....
	Pumping plants:								
23	Engine capacity ..... horsepower..	.....	.....	.....	.....	.....	.....	.....	.....
24	Pump capacity ..... gallons per minute..	.....	.....	.....	.....	.....	.....	.....	.....
25	Area served by pumps ..... acres..	.....	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only [1] ..... acres..	12,618	4,238	67,567	7,000	15,792	1,028	4,600	6,580
27	Length of these ditches ..... miles..	38.2	19.8	153.4	7.0	30.5	7.5	17.1	28.0
28	Average length per acre ..... feet..	16.0	24.7	12.0	5.3	10.2	38.5	19.6	22.5
29	Area having open ditches and levees [1] ..... acres..	1,687	.....	.....	.....	.....	.....	.....	.....
30	Length of these ditches ..... miles..	6.8	.....	.....	.....	.....	.....	.....	.....
31	Average length per acre ..... feet..	21.3	.....	.....	.....	.....	.....	.....	.....
32	Length of the accessory levees ..... miles..	1.0	.....	.....	.....	.....	.....	.....	.....
33	Area drained by tile only [1] ..... acres..	.....	22	.....	.....	.....	.....	.....	270
34	Length of these tile ..... miles..	.....	1.0	.....	.....	.....	.....	.....	4.0
35	Average length per acre ..... feet..	.....	240.0	.....	.....	.....	.....	.....	78.5
36	Area drained by open ditches and tile [1] ..... acres..	.....	1,700	.....	54,847	.....	4,146	.....	250
37	Length of these drains ..... miles..	.....	6.0	.....	120.4	.....	57.2	.....	2.0
38	Average length per acre ..... feet..	.....	18.6	.....	11.6	.....	72.8	.....	42.2
39	Area having open ditches, tile drains, and levees [1] ..... acres..	4,000	.....	.....	.....	.....	.....	.....	.....
40	Length of these drains ..... miles..	44.2	.....	.....	.....	.....	.....	.....	.....
41	Average length per acre ..... feet..	58.3	.....	.....	.....	.....	.....	.....	.....
42	Length of the accessory levees ..... miles..	2.5	.....	.....	.....	.....	.....	.....	.....
	DEVELOPMENT OF LAND.								
43	Improved land in operating enterprises, 1920 ..... acres..	5,468	4,462	21,734	47,265	5,372	1,104	2,970	561
44	Improved land prior to drainage ..... acres..	1,463	278	.....	22,276	43	105	1,120	25
45	Increase since drainage ..... acres..	4,005	4,184	21,734	24,989	5,329	999	1,850	536
46	Per cent of increase [2]	273.8	.....	.....	112.2	.....	951.4	165.2	.....
47	Per cent increase is of all improved land in farms, 1920	1.7	3.9	8.7	17.1	1.6	2.1	1.0	0.2
48	Timber and cut-over land, 1920 ..... acres..	649	928	.....	2,920	.....	174	.....	3,206
49	Timber and cut-over land prior to drainage ..... acres..	2,905	1,202	7,746	2,920	.....	174	.....	3,387
50	Decrease since drainage ..... acres..	2,256	274	7,746	.....	.....	.....	.....	181
51	Per cent of decrease	77.7	22.8	100.0	.....	.....	.....	.....	5.3
52	Other unimproved land, 1920 ..... acres..	12,188	570	45,833	11,662	10,420	3,896	1,630	3,339
53	Other unimproved land prior to drainage ..... acres..	13,937	4,480	59,821	36,651	15,749	4,895	3,480	3,694
54	Decrease since drainage ..... acres..	1,749	3,910	13,988	24,989	5,329	999	1,850	355
55	Per cent of decrease	12.5	87.3	23.4	68.2	33.8	20.4	53.2	9.6
56	Swampy or subject to overflow, 1920 ..... acres..	530	.....	5,500	5,562	4,656	712	720	4,000
57	Swampy or subject to overflow prior to drainage ..... acres..	11,088	5,960	67,567	49,907	15,792	3,740	4,600	7,106
58	Decrease since drainage ..... acres..	10,558	5,960	62,067	44,345	11,136	3,028	3,880	3,106
59	Per cent of decrease	95.2	100.0	91.9	88.9	70.5	81.0	84.3	43.7
	CAPITAL INVESTED AND COST PER ACRE.								
60	Total capital invested in and required for completion of operating enterprises ..... dollars..	167,540	63,160	441,920	406,000	88,375	82,516	10,490	260,033
61	Capital invested in these enterprises to Dec. 31, 1919 ..... dollars..	117,540	60,160	441,920	406,000	88,375	69,516	9,740	135,033
62	Additional capital required to complete these enterprises ..... dollars..	50,000	3,000	.....	.....	.....	13,000	750	125,000
63	Average cost per acre when completed ..... dollars..	9.15	10.60	6.54	6.56	5.60	15.95	2.28	36.59
64	Enterprises constructing open ditches only ..... dollars..	59,874	24,660	441,920	35,000	88,375	7,617	10,490	238,900
65	Average cost per acre when completed ..... dollars..	4.75	5.82	6.54	5.00	5.60	7.41	2.28	36.31
66	Enterprises constructing open ditches and levees ..... dollars..	14,666	.....	.....	.....	.....	.....	.....	.....
67	Average cost per acre when completed ..... dollars..	8.69	.....	.....	.....	.....	.....	.....	.....
68	Enterprises constructing tile drains only ..... dollars..	.....	1,000	.....	.....	.....	.....	.....	8,633
69	Average cost per acre when completed ..... dollars..	.....	45.45	.....	.....	.....	.....	.....	31.28
70	Enterprises constructing open ditches and tile drains ..... dollars..	.....	37,500	.....	371,000	.....	74,899	.....	12,500
71	Average cost per acre when completed ..... dollars..	.....	22.06	.....	6.76	.....	18.07	.....	50.00
72	Enterprises constructing open ditches, tile drains, and levees ..... dollars..	93,000	.....	.....	.....	.....	.....	.....	.....
73	Average cost per acre when completed ..... dollars..	23.25	.....	.....	.....	.....	.....	.....	.....
	CROPS.								
74	Improved land in enterprises reporting—								
75	Hay as principal crop on drained land ..... acres..	4,068	1,575	20,054	.....	.....	865	1,570	150
76	Corn as principal crop on drained land ..... acres..	.....	2,887	.....	39,713	5,372	.....	.....	411
77	Small grains as principal crop on drained land ..... acres..	.....	.....	1,080	.....	.....	.....	1,400	.....
78	Vegetables as principal crop on drained land ..... acres..	.....	.....	.....	.....	.....	239	.....	.....
79	Other crops as principal ones on drained land ..... acres..	1,400	.....	600	7,552	.....	.....	.....	.....
80	Not reporting principal crop on drained land ..... acres..	.....	.....	.....	.....	.....	.....	.....	.....

[1] When works under construction have been completed.

[2] Per cent not shown when more than 1,000.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Trempealeau.	Walworth.	Washington.	Waukesha.	Waushara.	Winnebago.	Wood.	Other counties.[1]
	LAND AREA.								
1	Approximate land area of the county—acres	478,720	358,400	275,840	351,360	413,440	293,760	517,760	5,087,360
2	All land in operating drainage enterprises—acres	4,301	8,910	4,500	7,848	7,240	6,246	64,343	20,209
3	Improved land—acres	430	4,048	330	4,757	456	3,710	18,911	10,410
4	Per cent of all improved land in farms	0.2	1.7	0.2	2.1	0.2	2.0	13.8	0.5
5	Timber and cut-over land—acres	2,581	.....	2,825	419	190	.....	4,536	1,833
6	Other unimproved land—acres	1,290	4,862	1,345	2,672	6,594	2,536	40,896	7,966
7	Swampy or subject to overflow, in enterprises—acres	.....	.....	.....	501	794	.....	.....	3,199
8	Suffering loss of crops from defective drainage—acres	.....	.....	.....	288	57	.....	.....	440
9	Assessed acreage—acres	4,301	8,910	4,500	7,848	7,240	6,246	64,343	20,209
10	Excess over all land in enterprises—acres	.....	.....	.....	.....	.....	.....	.....	.....
	DRAINAGE WORKS.								
	Open ditches:								
11	Completed—miles	7.3	23.3	20.5	35.1	16.9	10.0	137.0	85.2
12	Additional under construction—miles	.....	.....	.....	.....	.....	.....	.....	.....
13	Maximum completed in any enterprise—miles	7.3	11.2	7.5	10.0	9.0	6.0	47.0	15.0
14	Maximum width at bottom of ditch [2]—feet	30	20	25	20	16	10	60	30
15	Maximum of average depths of outlet ditches [2]—feet	6.0	9.0	8.0	8.0	8.0	7.0	10.0	10.0
16	Mean depth of branch ditches [2]—feet	6.0	7.0	7.0	4.9	8.0	.....	7.1	5.0
	Tile drains:								
17	Completed—miles	.....	7.5	0.5	5.0	.....	.....	.....	.....
18	Additional under construction—miles	.....	.....	.....	.....	.....	.....	.....	.....
19	Maximum completed in any enterprise—miles	.....	6.0	0.5	5.0	.....	.....	.....	.....
20	Maximum size of tile [2]—inches	.....	14	8	10	.....	.....	.....	.....
	Accessory levees and dikes:								
21	Completed—miles	4.8	.....	.....	.....	.....	.....	0.8	0.3
22	Additional under construction—miles	.....	.....	.....	.....	.....	.....	.....	.....
	Pumping plants:								
23	Engine capacity—horsepower	([3])	.....	.....	.....	.....	.....	.....	150
24	Pump capacity—gallons per minute	([3])	.....	.....	.....	.....	.....	.....	.....
25	Area served by pumps—acres	4,301	.....	.....	.....	.....	.....	.....	2,296
26	Area drained by open ditches only [2]—acres	.....	4,810	4,300	6,348	7,240	6,246	49,983	17,913
27	Length of these ditches—miles	.....	14.7	19.5	25.1	16.9	10.0	90.0	83.2
28	Average length per acre—feet	.....	16.1	23.9	20.9	12.3	8.5	9.5	24.5
29	Area having open ditches and levees [2]—acres	4,301	.....	.....	.....	.....	.....	14,360	2,296
30	Length of these ditches—miles	7.3	.....	.....	.....	.....	.....	47.0	2.0
31	Average length per acre—feet	9.0	.....	.....	.....	.....	.....	17.3	4.6
32	Length of the accessory levees—miles	4.8	.....	.....	.....	.....	.....	0.8	0.3
33	Area drained by tile only [2]—acres	.....	280	.....	.....	.....	.....	.....	.....
34	Length of these drains—miles	.....	1.5	.....	.....	.....	.....	.....	.....
35	Average length per acre—feet	.....	28.3	.....	.....	.....	.....	.....	.....
36	Area drained by open ditches and tile [2]—acres	.....	3,820	200	1,500	.....	.....	.....	.....
37	Length of these drains—miles	.....	14.6	1.5	15.0	.....	.....	.....	.....
38	Average length per acre—feet	.....	20.2	39.6	52.8	.....	.....	.....	.....
39	Area having open ditches, tile drains, and levees [2]—acres	.....	.....	.....	.....	.....	.....	.....	.....
40	Length of these drains—miles	.....	.....	.....	.....	.....	.....	.....	.....
41	Average length per acre—feet	.....	.....	.....	.....	.....	.....	.....	.....
42	Length of the accessory levees—miles	.....	.....	.....	.....	.....	.....	.....	.....
	DEVELOPMENT OF LAND.								
43	Improved land, in operating enterprises, 1920—acres	430	4,048	330	4,757	456	3,710	18,911	10,410
44	Improved land prior to drainage—acres	.....	130	40	.....	.....	.....	200	1,410
45	Increase since drainage—acres	430	3,918	290	4,757	456	3,710	18,711	9,000
46	Per cent of increase [4]	.....	.....	725.0	.....	.....	.....	.....	638.3
47	Per cent increase is of all improved land in farms, 1920	0.2	1.6	0.2	2.1	0.2	2.0	13.7	0.4
48	Timber and cut-over land, 1920—acres	2,581	.....	2,825	419	190	.....	4,536	1,833
49	Timber and cut-over land prior to drainage—acres	2,581	.....	2,975	1,169	570	.....	7,279	2,163
50	Decrease since drainage—acres	.....	.....	150	750	380	.....	2,743	330
51	Per cent of decrease	.....	.....	5.0	64.2	66.7	.....	37.7	15.3
52	Other unimproved land, 1920—acres	1,290	4,862	1,345	2,672	6,594	2,536	40,896	7,966
53	Other unimproved land prior to drainage—acres	1,720	8,780	1,485	6,679	6,670	6,246	56,864	16,636
54	Decrease since drainage—acres	430	3,918	140	4,007	76	3,710	15,968	8,670
55	Per cent of decrease	25.0	44.6	9.4	60.0	1.1	59.4	28.1	52.1
56	Swampy or subject to overflow, 1920—acres	.....	.....	.....	501	794	.....	.....	3,199
57	Swampy or subject to overflow prior to drainage—acres	4,301	8,910	4,500	7,848	7,240	6,246	59,807	16,061
58	Decrease since drainage—acres	4,301	8,910	4,500	7,347	6,446	6,246	59,807	12,862
59	Per cent of decrease	100.0	100.0	100.0	93.6	89.0	100.0	100.0	80.1
	CAPITAL INVESTED AND COST PER ACRE.								
60	Total capital invested in and required for completion of operating enterprises—dollars	50,000	63,465	64,500	44,835	27,000	20,400	394,200	143,463
61	Capital invested in these enterprises to Dec. 31, 1919—dollars	50,000	63,465	64,500	44,835	27,000	20,400	394,200	143,463
62	Additional capital required to complete these enterprises—dollars	.....	.....	.....	.....	.....	.....	.....	.....
63	Average cost per acre when completed—dollars	11.63	7.12	14.33	5.71	3.73	3.27	6.13	7.10
64	Enterprises constructing open ditches only—dollars	.....	33,560	59,500	27,835	27,000	20,400	250,700	118,463
65	Average cost per acre when completed—dollars	.....	6.98	13.34	4.38	3.73	3.27	5.02	6.61
66	Enterprises constructing open ditches and levees—dollars	50,000	.....	.....	.....	.....	.....	143,500	25,000
67	Average cost per acre when completed—dollars	11.63	.....	.....	.....	.....	.....	9.99	10.89
68	Enterprises constructing tile drains only—dollars	.....	4,905	.....	.....	.....	.....	.....	.....
69	Average cost per acre when completed—dollars	.....	17.52	.....	.....	.....	.....	.....	.....
70	Enterprises constructing open ditches and tile drains—dollars	.....	25,000	5,000	17,000	.....	.....	.....	.....
71	Average cost per acre when completed—dollars	.....	6.54	25.00	11.33	.....	.....	.....	.....
72	Enterprises constructing open ditches, tile drains, and levees—dollars	.....	.....	.....	.....	.....	.....	.....	.....
73	Average cost per acre when completed—dollars	.....	.....	.....	.....	.....	.....	.....	.....
	CROPS.								
74	Improved land in enterprises reporting—								
75	Hay as principal crop on drained land—acres	430	.....	.....	311	456	882	8,265	6,736
76	Corn as principal crop on drained land—acres	.....	4,048	330	3,696	.....	2,828	.....	3,674
77	Small grains as principal crop on drained land—acres	.....	.....	.....	750	.....	.....	5,026	.....
78	Vegetables as principal crop on drained land—acres	.....	.....	.....	.....	.....	.....	.....	.....
79	Other crops as principal ones on drained land—acres	.....	.....	.....	.....	.....	.....	5,020	.....
80	Not reporting principal crop on drained land—acres	.....	.....	.....	.....	.....	.....	.....	.....

[1] Includes only Barron, Brown, Buffalo, Burnett, Calumet, Green, Green Lake, Manitowoc, Marinette, Polk, and Waupaca counties.
[2] When works under construction have been completed. [3] Pumping plant located in Buffalo County. [4] Per cent not shown when more than 1,000.

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FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT OF COMMERCE

BULLETIN

BUREAU OF THE CENSUS

DRAINAGE : WYOMING

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

INTRODUCTION.

This bulletin presents the statistics of drainage for Wyoming collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land that is not yet included in farms.

The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are shown separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

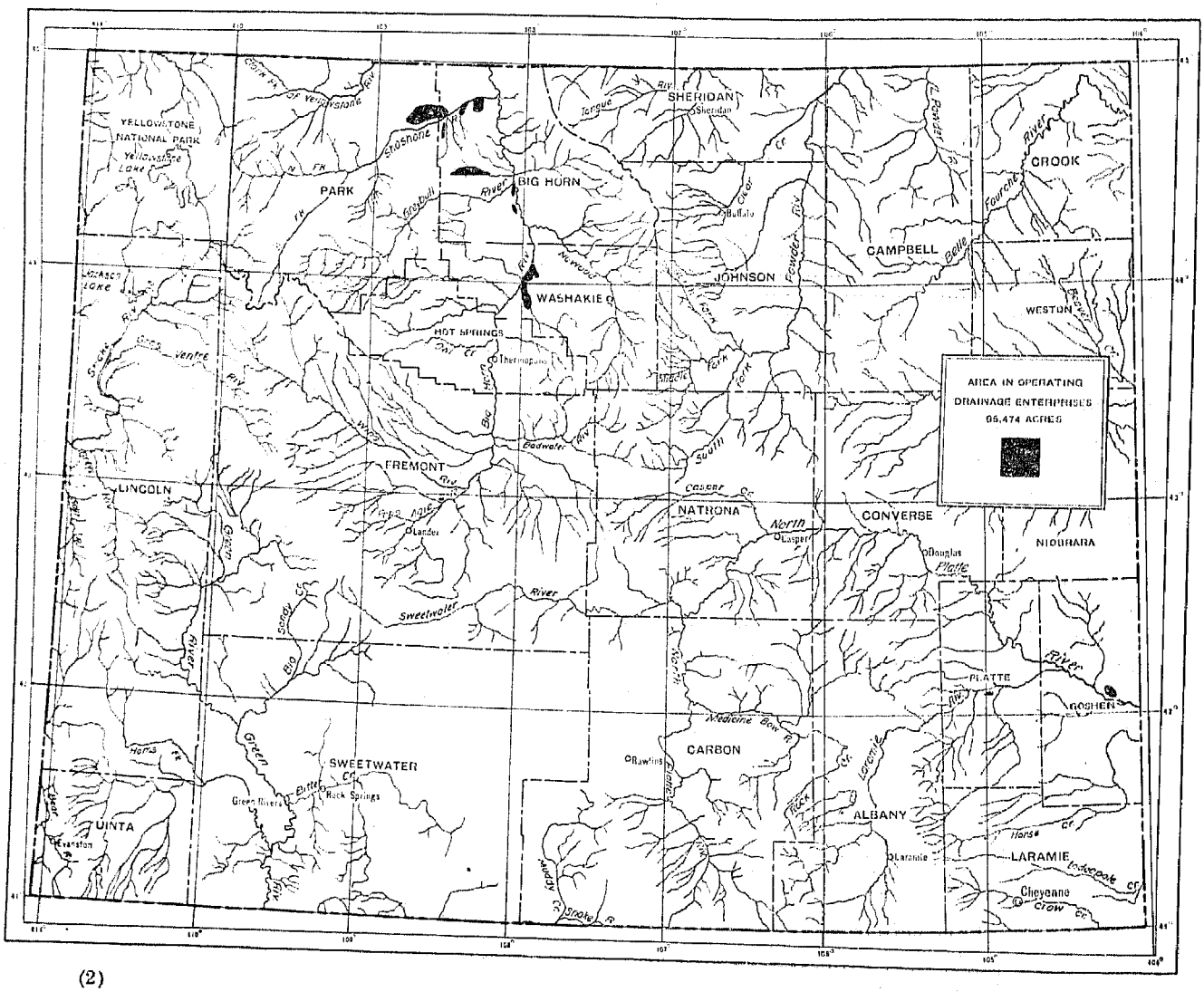
ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state	15,748	100.0
Farms reporting land having drainage	433	2.7
Farms reporting land needing drainage	1,127	7.2
All land in farms—acres	11,809,351	100.0
Improved land in farms—acres	2,102,005	17.8
Farm land reported as provided with drainage—acres	35,654	0.3
Farm land reported as needing drainage—acres	69,066	0.6
DRAINAGE ENTERPRISES.		
Approximate land area of the state—acres	62,430,720	100.0
All land in operating drainage enterprises—acres	95,474	0.2
Improved land—acres	84,846	0.1
Unimproved land [1]—acres	10,628	(2)
Capital invested in and required for completion of operating enterprises	$1,667,367	100.0
Capital invested in these enterprises to Dec. 31, 1919	$1,175,962	70.5
Additional capital required to complete these enterprises	$491,405	29.5

[1] No timber or cut-over land reported.

[2] Less than one-tenth of 1 per cent.

WYOMING

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purposes of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for the growing of crops by reason of the drainage. This is to be distinguished from the area merely provided with drainage outlet facilities through the organization of drainage enterprises. Drainage on farms represents in some cases the result of work done independently by the farm owner, and in other cases work done on the farm to supplement the work of the drainage enterprise in which the farm is located.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swampy or overflowed lands for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise. However, the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (*a*) improved land; (*b*) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (*c*) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL.[1]		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All organized enterprises	107,041	100.0	$1,182,362	100.0	$901,873
Operating enterprises	95,474	89.2	1,175,962	99.5	491,405
With works completed	11,740	11.0	32,231	2.7	
With works under construction	83,734	78.2	1,143,731	96.7	491,405
Nonoperating enterprises	11,567	10.8	6,400	0.5	410,468

[1] The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Of the total area in operating drainage enterprises in Wyoming, 44 per cent is situated in Big Horn County, and nearly all is in the valley of Big Horn River in the north central part of the state. There are two enterprises in the eastern part, and a very small one in Fremont County.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All organized enterprises	107,041	100.0	$1,182,362	100.0	$901,873
Operating enterprises	95,474	89.2	1,175,962	99.5	491,405
Platte River	3,264	3.0	18,896	1.6	4,224
Big Horn River	92,210	86.1	1,157,066	97.9	487,181
Nonoperating enterprises	11,567	10.8	6,400	0.5	410,468
Big Horn River	11,567	10.8	6,400	0.5	410,468

Condition of land in enterprises.—All the drainage enterprises in this state are reported as organized for the purpose of draining or protecting land injured or threatened with water-logging or the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. For the state, 19,622 acres of land in drainage districts are reported as not having needed drainage, but as having been assessed merely for contributing to the injury of the other land.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises	95,474	100.0	11,740	83,734	11,567
Improved land	84,846	88.9	11,140	73,706	7,513
Unimproved land[1]	10,628	11.1	600	10,028	4,054
Swampy, seeped, or alkali	20,785	21.8	2,700	18,085	6,554
Suffering a loss of crops	6,595	6.9	2,165	4,430	1,000

[1] No timber or cut-over land reported.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 15 operating drainage enterprises are counted in Wyoming, with an average area of 6,365 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises	95,474	95,474	100.0
Less than 200 acres	140	140	0.1
200 to 499 acres			
500 to 999 acres	500	500	0.5
1,000 to 4,999 acres	21,514	21,514	22.5
5,000 to 9,999 acres	27,400	27,400	28.7
10,000 acres and over	45,920	45,920	48.1

Character of enterprises.—The drainage enterprises in Wyoming comprise drainage districts organized under the general drainage law approved March 1, 1911 (ch. 95), irrigation projects of the United States Reclamation Service, and two very small enterprises under the United States Indian Service and under individual ownership, respectively.

Drainage districts under the statute of 1911 are established by the district court of any county in which a part of the land to be affected is located. The district may comprise separated areas, if the court finds that drainage of all parts will be of public benefit and can be accomplished most economically as one undertaking. A petition for establishment must be signed by a majority of the owners representing at least one-third of the acreage, or by the owners of more than one-half the acreage in the proposed district. A preliminary investigation as to the practicability, public utility, probable benefits, and cost of the project is made by three commissioners appointed by the court. These commissioners become the executive officers of the district when it is established, to prepare the plan of improvement works, to assess damages and benefits to the property in the district, and to secure construction of the drainage works. The court holds public hearings to determine the sufficiency of the petition before appointing the commissioners, to discuss the preliminary report of the commissioners before establishing the district, and to consider objections to the commissioners' final report before approving the work and confirming the assessments of benefits and damages. Appeals regarding the assessments may be taken to the supreme court of the state. Bonds of the district may be issued by the commissioners.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All drainage enterprises	107,041	100.0	$1,182,362	100.0	$901,873
Operating enterprises	95,474	89.2	1,175,962	99.5	491,405
Drainage districts	60,834	56.8	638,662	54.0	491,405
U. S. Reclamation projects [1]	34,640	32.4	537,300	45.4	.....
Nonoperating enterprises	11,567	10.8	6,400	0.5	410,468
Drainage districts	11,567	10.8	6,400	0.5	410,468

[1] Includes 140 acres under U. S. Indian Service and 500 acres under individual ownership.

The United States Reclamation Service may provide drainage and protection for the land in its irrigation projects as it may deem necessary. An act of the legislature, February 27, 1919 (ch. 142), authorizes cooperation between drainage and irrigation districts and the United States Reclamation Service in the construction of drainage and irrigation works.

An amendment to the drainage law, made March 5, 1915 (ch. 155), does not affect the character of those enterprises as described, and is the only other law of the state relating to drainage enterprises.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 25.1 miles of open ditches and 114.2 miles of tile drains; the additional lengths under construction were 1.3 miles of open ditches and 71.8 miles of tile drains. These figures do not include drains installed by individual farm owners supplemental to the works of the enterprises. There are no pumping districts for land drainage in the state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All kinds	95,474	100.0	$1,175,962	100.0	$491,405
Open ditches only	3,404	3.6	25,127	2.1	4,224
Tile drains only	54,650	57.2	590,039	50.2	269,133
Open ditches and tile drains	37,420	39.2	560,796	47.7	218,048

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises	95,474	100.0
4.0 to 4.9 feet	500	0.5
8.0 to 8.9 feet	34,000	35.6
Not reporting branches	60,974	63.9

Maintenance of works.—The drainage law of 1911 provides for the maintenance of the drainage districts by the district commissioners, and authorizes assessments for such work to be levied against the land in the same proportion as the cost of original construction. It requires the commissioners to submit to the court each year a report stating the probable needs of the district for the next fiscal year, which is confirmed by the court at a hearing to determine objections.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
			To Dec. 31, 1919.		
	Acreage.	Per cent of total.	Amount.	Per cent of total.	Additional required to complete.
All operating enterprises	95,474	100.0	$1,175,962	100.0	$491,405
By district forces	45,390	47.5	697,300	59.3	259,775
By contract	8,400	8.8	8,000	0.7	
By method not specified	3,000	3.1	70,000	6.0	30,000
No maintenance provided	30,984	32.5	294,662	25.1	181,630
Not reported	7,700	8.1	106,000	9.0	20,000

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the district courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of drainage was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises	95,474	100.0	95,474	100.0
1910 to 1914	61,740	64.7	61,740	64.7
1915 to 1919	33,734	35.3	33,734	35.3

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises	$1,175,962	100.0	$491,405
1910 to 1914	684,069	58.2	231,775
1915 to 1919	491,893	41.8	259,630

TABLE 12.—DRAINS (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains	26.4	100.0	186.0	100.0
1910 to 1914	20.0	75.8	105.0	56.5
1915 to 1919	6.4	24.2	81.0	43.5

Crops.—The principal crops grown upon the drained land in drainage enterprises are alfalfa and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Big Horn.	Carbon.	Fremont.	Johnson.
1	Number of all farms in the state or county	15,748	998	413	969	624
2	Farms reporting land having drainage	433	108	7	20	8
3	Farms reporting land needing drainage	1,127	276	13	115	19
4	Farms in drainage and levee districts	337	129	.....	9	.....
	LAND AND FARM AREA.					
5	Approximate land area of the state or county—acres	[1]62,430,720	1,990,400	5,124,480	7,847,040	2,664,960
6	All land in farms—acres	11,809,351	190,445	843,520	449,331	472,611
7	Improved land in farms—acres	2,102,005	93,661	102,113	120,291	71,232
8	Woodland in farms—acres	421,806	7,830	14,566	8,750	5,163
9	Other unimproved land in farms—acres	9,285,540	88,954	726,841	320,290	396,216
10	Farm land reported as provided with drainage—acres	35,654	7,505	525	743	906
11	Farm land reported as needing drainage—acres	69,066	16,138	802	6,468	1,305
12	Drainage only—acres	23,837	10,992	377	3,295	755
13	Drainage and clearing—acres	45,229	5,146	425	3,163	550

[1] Includes 1,886,720 acres in Yellowstone National Park.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Lincoln.	Park.	Platte.	Sheridan.	Washakie.	All other counties.[1]
1	Number of all farms in the county	923	839	1,146	972	318	8,546
2	Farms reporting land having drainage	8	204	10	18	34	16
3	Farms reporting land needing drainage	218	166	25	87	65	143
4	Farms in drainage and levee districts	.....	161	5	2	29	2
	LAND AND FARM AREA.						
5	Approximate land area of the county—acres	5,724,800	3,332,480	1,360,000	1,647,360	1,434,240	29,418,240
6	All land in farms—acres	441,212	286,193	974,429	625,796	93,379	7,432,435
7	Improved land in farms—acres	182,091	89,683	180,303	113,385	37,607	1,111,639
8	Woodland in farms—acres	10,025	7,613	60,577	8,741	3,354	295,187
9	Other unimproved land in farms—acres	249,096	188,897	733,549	503,670	52,418	6,025,609
10	Farm land reported as provided with drainage—acres	917	10,155	2,288	763	4,818	1,034
11	Farm land reported as needing drainage—acres	16,793	2,678	798	2,165	2,919	19,010
12	Drainage only—acres	993	2,534	682	591	1,021	1,992
13	Drainage and clearing—acres	15,795	144	116	1,574	1,898	17,018

[1] No drainage on farms reported in Campbell, Converse, Crook, Hot Springs, Natrona, Niobrara, and Weston Counties.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		The State.	Big Horn.	Park.	Washakie.	Other counties.[1]
	LAND AREA.					
1	Approximate land area of the state or county—acres	[2]62,430,720	1,990,400	3,332,480	1,434,240	10,606,080
2	All land in operating drainage enterprises—acres	95,474	41,750	29,920	20,400	3,404
3	Improved land—acres	81,846	33,922	29,920	17,600	3,404
4	Per cent of all improved land in farms	4.0	36.2	33.4	46.8	0.7
5	Unimproved land [3]—acres	10,628	7,828	.....	2,800	.....
6	Swampy, seeped, or alkali, in enterprises—acres	20,785	18,787	598	1,400	.....
7	Suffering a loss of crops from defective drainage—acres	6,595	4,357	598	1,500	140
8	Assessed acreage—acres	95,474	41,750	29,920	20,400	3,404
9	Excess over all land in operating enterprises—acres	.....	.....	.....	.....	.....
	DRAINAGE WORKS.					
	Open ditches:					
10	Completed—miles	25.1	2.5	17.6	.....	5.0
11	Additional under construction—miles	1.3	0.8	.....	.....	0.5
12	Maximum completed in any enterprise—miles	17.6	2.4	17.6	.....	3.0
13	Maximum width at bottom of ditch [4]—feet	6	4	4	.....	6
14	Maximum of average depths of outlet ditches [4]—feet	12.0	8.5	8.5	.....	12.0
15	Mean depth of branch ditches [4]—feet	8.0	8.0	8.0	.....	4.0
	Tile drains:					
16	Completed—miles	114.2	43.9	47.1	23.2	.....
17	Additional under construction—miles	71.8	32.9	27.7	11.2	.....
18	Maximum completed in any enterprise—miles	47.1	16.0	47.1	16.0	.....
19	Maximum size of tile [4]—inches	24	24	18	18	.....
20	Area drained by open ditches only [4]—acres	3,404	.....	.....	.....	3,404
21	Length of these ditches—miles	5.5	.....	.....	.....	5.5
22	Average length per acre—feet	8.5	.....	.....	.....	8.5
23	Area drained by open ditches and tile [4]—acres	37,420	7,500	29,920	.....	.....
24	Length of these drains—miles	113.8	21.4	92.4	.....	.....
25	Average length per acre—feet	16.1	15.1	16.3	.....	.....
26	Area drained by tile only [4]—acres	54,650	34,250	.....	20,400	.....
27	Length of these tile—miles	93.1	58.7	.....	34.4	.....
28	Average length per acre—feet	9.0	9.0	.....	8.9	.....
	DEVELOPMENT OF LAND.					
29	Improved land in operating enterprises, 1920—acres	84,846	33,922	29,920	17,600	3,404
30	Improved land prior to drainage—acres	83,206	33,922	29,920	16,100	3,264
31	Increase since drainage—acres	1,640	.....	.....	1,500	140
32	Per cent of increase	2.0	.....	.....	9.3	4.3
33	Per cent increase is of all improved land in farms, 1920	0.1	.....	.....	4.0	[5]
34	Unimproved land, 1920 [3]—acres	10,628	7,828	.....	2,800	.....
35	Unimproved land prior to drainage—acres	12,268	7,828	.....	4,300	140
36	Decrease since drainage—acres	1,640	.....	.....	1,500	140
37	Per cent of decrease	13.4	.....	.....	34.9	100.0
38	Swampy, seeped, or alkali, 1920—acres	20,785	18,787	598	1,400	.....
39	Swampy, seeped, or alkali prior to drainage—acres	71,809	27,185	29,920	11,300	3,404
40	Decrease since drainage—acres	51,024	8,398	29,322	9,900	3,404
41	Per cent of decrease	71.1	30.9	98.0	87.6	100.0
	CAPITAL INVESTED AND COST PER ACRE.					
42	Total capital invested in and required for completion of operating enterprises—dollars	1,667,367	727,433	632,583	278,000	29,351
43	Capital invested in these enterprises to Dec. 31, 1919—dollars	1,175,962	550,027	442,808	158,000	25,127
44	Additional capital required to complete these enterprises—dollars	491,405	177,406	189,775	120,000	4,224
45	Average cost per acre when completed—dollars	17.46	17.42	21.14	13.63	8.62
46	Enterprises constructing open ditches only—dollars	29,351	.....	.....	.....	29,351
47	Average cost per acre when completed—dollars	8.62	.....	.....	.....	8.62
48	Enterprises constructing tile drains only—dollars	859,172	581,172	.....	278,000	.....
49	Average cost per acre when completed—dollars	15.72	16.97	.....	13.63	.....
50	Enterprises constructing open ditches and tile drains—dollars	778,844	146,261	632,583	.....	.....
51	Average cost per acre when completed—dollars	20.81	19.50	21.14	.....	.....
	CROPS.					
	Improved land in enterprises reporting—					
52	Alfalfa as principal crop on drained land—acres	54,364	4,080	29,920	17,600	2,764
53	Sugar beets as principal crop on drained land—acres	15,742	15,742	.....	.....	.....
54	Hay (other than alfalfa) as principal crop on drained land—acres	2,600	2,100	.....	.....	500
55	Not reporting principal crop on drained land—acres	12,140	12,000	.....	.....	140

[1] Includes only Fremont, Goshen, and Platte Counties.
[2] Includes 1,886,720 acres in Yellowstone National Park.
[3] No timber or cut-over land reported.
[4] When works under construction have been completed.
[5] Less than one-tenth of 1 per cent.

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